COMMONWEALTH OF VIRGINIA

YORK RIVER AND LOWER YORK COASTAL BASINS TRIBUTARY NUTRIENT REDUCTION STRATEGY

FEBRUARY 2000

Virginia Secretary of Natural Resources
Virginia Department of Conservation and Recreation
Virginia Department of Environmental Quality
Virginia Chesapeake Bay Local Assistance Department

VIRGINIA'S YORK RIVER and LOWER YORK COASTAL BASINS TRIBUTARY NUTRIENT REDUCTION STRATEGY

TABLE OF CONTENTS

I. Background and Introduction 1

II. York River Basin Water Quality and Living Resources 9

Regional Loading Profiles:
- Upper York Basin 19
- Central York Basin 25
- Lower York Basin 31
- Lower York Coastal Basin 37

III. Assessment of Basin Nutrient Issues, Progress, and Control Options . . . 54

Regional Reduction Interpolations for 2000, 2004, and 2010
- Upper York Basin 66
- Central York Basin 69
- Lower York Basin 72

IV. Completion of the Final Strategy 81

V. Evaluation of Strategy Implementation 98

Appendix A: Local Profiles

Appendix B: York Basin Point Source Discharges

Appendix C: Report on Progress of Toxics Reduction Strategy

Appendix D: Explanation of BMPs, Their Costs and Efficiences

Appendix E: Middle Peninsula Nutrient Reduction Strategies Report

Appendix F: York Technical Committee Members to Date

Appendix G: Report on Objectives of the Local Government Parternship Initiative

Appendix H: Report on SAV Restoration Progress

This York River strategy has been produced through the efforts of a number of individuals representing state and local governments, agriculture, business, industry, wastewater plant operators, citizens' groups and many others. Special thanks for the contributions of the following: the York Watershed Council, including each of its member Soil and Water Conservation Districts, Billy Mills, and its other members; the Department of Environmental Quality, particularly Al Pollock, John Kennedy, Dr. Arthur Butt, Rick Hoffman, Mark Richards, Chris Brackett, Diana Baumann, and Collin Powers; the Department of Conservation and Recreation, especially Wayne Davis, Susan Townsend, James Davis-Martin, Terry Moss, William Clement, Kenny Harper, Moira Croghan, Mark Bennett, Diane McCarthy, Jutta Schneider, Mary Apostolico, Dawn Shank, Karl Huber and Cleo Stevens; John Carlock and Hugo Valverde with the Hampton Roads Planning District Commission; Rich Batiuk with the Environmental Protection Agency, Dr. Carl Hershner, Jr., Marcia Berman, and Julie Herman with the Virginia Institute of Marine Science; Jean Tingler and Stu Blankenship with the Virginia Economic Development Partnership, Shawn Smith with the Chesapeake Bay Local Assistance Department, and Scott Kudlas, former York Tributary Team Leader, who coordinated the initial York strategy, which the final strategy is largely derived.

The continued participation of everyone involved will make the outcome of this effort successful. Please provide comments to:

Darryl M. Glover
Department of Conservation and Recreation
Division of Soil and Water Conservation
York Watershed Office
P.O. Box 1425
Tappahannock, Virginia 23560
(804)443-6752
(804)443-4534, fax
E-mail <dglover@dcr.state.va.us>

EXECUTIVE SUMMARY

The *York River and Lower York Coastal Basins Tributary Nutrient Reduction Strategy* was developed over several years through the collective efforts of stakeholders in the watershed and an inter-agency team under the Secretariat of Natural Resources. The primary purpose of the Strategy is to restore habitat conditions and support living resources in the York River, its tributaries, and the Lower York Coastal Basins.

Nonpoint sources were identified as contributing approximately 80% of the total controllable nutrient load in the York watershed. Point sources contribute about 20%. The Strategy aims to further reduce nutrients from both types of sources, and to reduce sediments as well. During various seasons of the year, and in various portions of the watershed, nitrogen, phosphorus, or sediment has been identified as the constituent of major concern through monitoring. A collection of both nonpoint and point source management measures, called the Year 2010 Scenario, was developed by a group of stakeholders and the inter-agency Tributary Team to reduce both nutrients and sediment. If fully implemented, the Year 2010 Scenario is projected to achieve reductions of 2.3 million pounds of nitrogen, 60,000 pounds of phosphorus, and 9,000 tons of sediment from 1996 levels. Stakeholders also suggested enhancements to Virginia's Cost Share Program to help implement these management measures. Costs to implement the Strategy are estimated at just over $45,000,000 over a ten-year period. Funding to implement the Strategy will be provided by the Water Quality Improvement Fund (the Fund) and other sources.

There was broad agreement among participating stakeholders on the nonpoint source management measures in the Year 2010 Scenario. Biological Nutrient Removal level of treatment (or equivalent) for municipal wastewater and industrial facilities with flow capacity of 1,000,000 gallons per day or greater, was recommended by the Tributary Team. Municipal point source representatives indicated they could not agree with this recommendation. They expressed the opinion that the environmental benefits and cost-effectiveness of implementing point source nutrient reductions was in question. The unknown regulatory effects of expected nutrient criteria from the federal Environmental Protection Agency (EPA), and the development of a Total Maximum Daily Load (TMDL) for the tidal York River, were also noted. Financial assistance for point source facilities, through the Fund, can now be applied for, on a competitive basis, for qualified costs related to improvements in water quality. To address the questions concerning the expected benefits of point source nutrient reductions, EPA has agreed to conduct a point source only model run for the York watershed, which will isolate the benefits expected for living resources that would be achieved by the proposed point source management measures. This information will be evaluated when reduction goals and the management measures needed to achieve them by the Year 2010 are revised (in the Year 2002), after water quality endpoints are developed for the York and its tidal tributaries.

If endpoints are met by the Year 2010, TMDLs will not be required for the York or its tidal tributaries, and these water bodies will be removed from the impaired waters list. Progress with implementation of (the revised) Strategy will be evaluated in the Year 2004.

I. BACKGROUND AND INTRODUCTION

A TRIBUTARY STRATEGY PLAN FOR THE YORK RIVER

This is Virginia's *Tributary Nutrient Reduction Strategy for the York River Basin.* It sets forth actions that have been taken to date, and actions that will be taken, to help Virginia citizens and government restore the water quality and living resources of the York River. This strategy identifies practical, cost-effective and equitable methods to reduce nutrient and sediment loads to the York River, the Piankatank River, and Mobjack Bay. This strategy relied on local decision-making and public participation to arrive at solutions tailored to the unique land uses, resources and characteristics of the York River basin.

This document fulfills two commitments made by the Commonwealth of Virginia to develop tributary specific restoration plans. The first commitment was made by the executive branch through former Governor Robb's signature of the 1983 Chesapeake Bay Agreement, and was reaffirmed through subsequent Bay Program Directives signed by former Governor Baliles in 1987, Governor Wilder in 1993 and former Governor Allen in 1997. This committment has been fully supported by Governor Gilmore. The second was made through the General Assembly's passage of tributary strategy legislation in 1996 (Sections 2.1-51.12:1 through 2.1-51.12:3 of the Code of Virginia), which includes requirements and deadlines for tributary strategies for the York River and Chesapeake Bay coastal basins (hereinafter the western coastal basins of Mobjack Bay and the Piankatank are assumed to be included when the York River basin is stated).

This tributary strategy is a plan that identifies practical and cost-effective methods to reduce nutrient and sediment loads to the York River. The goal of the strategy is to reestablish York River habitat conditions, particularly dissolved oxygen and submerged aquatic vegetation, for the purposes of restoring fisheries and other living resources. This tributary strategy is based on the best available science, monitoring, computer modeling, local decision-making and the involvement of citizens and interest groups who chose to participate. This foundation promotes solutions that are tailored to the unique land uses, living resources and other characteristics of the York River and basin. Implementation of tributary strategies is voluntary and activities consistent with this plan may be eligible for cost-share funding under Virginia's Water Quality Improvement Act.

Virginia's tributary strategy initiative began with the development of a strategy for the Shenandoah and Potomac River basins as part of the Chesapeake Bay Program effort to reduce controllable nutrient loadings into the main Bay by 40% by the year 2000. This initial focus on the Potomac River basin stemmed from Bay Program computer modeling information, developed during a 1992 reevaluation, which showed that the nutrient loads from the Potomac River and all rivers north had substantial impacts on the Bay's water quality problems. This same modeling effort demonstrated that the nutrient loads coming from Virginia's lower tributaries, the Rappahannock, York and James, had much less of an impact on the mainstem Bay waters. The 40% reduction commitment, therefore, applied only to the Potomac River basin in Virginia.

For this reason, Virginia's *York Strategy* has been developed for the primary purpose of restoring habitat conditions and supporting living resources in the York River itself. Just like the 40% nutrient reduction goal for the entire Bay, the nutrient and sediment goals for the York River are based on the results of sophisticated computer modeling for the Chesapeake Bay and Virginia's lower tributaries. These goals provide the near term target for the efforts that are being proposed and undertaken through this strategy.

The *York Strategy* is a final tributary strategy plan however, it will need to be re-evaluated. This re-evaluation will address new goals, called environmental endpoints, which will determine the level of water quality needed to remove the York River, and its tidal tributaries, from the impaired waters list (see Section V). The re-evaluation will also incorporate the effects of growth in the watershed by examining updated land use information and point source load projections. Nonpoint source goals have been established for the basin. Delays in the Tributary Water Quality model until the Spring of 1999, uncertainties at the time about the effect of Total Maximum Daily Loads, and the pending development of nutrient criteria by the Environmental Protection Agency have postponed setting point source reduction goals for the York basin. However, the absence of final point source goals need not prevent implementation of nonpoint source practices identified in the *York Strategy,* and point source control actions that plan owners are willing to undertake, that are cost-effective and beneficial to reducing nutrient and sediments in the basin. Nonpoint sources were identified in the model as contributing roughly 80% of the total controllable nutrient load in the York River and basin. Many of the nonpoint source nutrient controls are already being implemented by citizens, local governments and businesses in the basin. These types of controls can be expanded through additional voluntary actions, and through the use of future nonpoint source cost-share funds.

The York Strategy process has already involved soil and water conservation districts, local governments, and many other stakeholders throughout the York basin. It is an ongoing process that will continue to be enhanced by local input, better scientific information, improved nutrient reduction technology and other factors. Most importantly, a broad group of stakeholders in the basin were invited to participate in the setting of final nonpoint nutrient and sediment reduction goals for the York River during mid-1999.

Chesapeake Bay Program Goals

From its start with the *1983 Chesapeake Bay Agreement*, the federal-interstate Chesapeake Bay Program has targeted nutrient reduction as a principal means of restoring the Bay. Beginning with general statements of intent to improve and protect the water quality and living resources of the Bay, the signatory jurisdictions refined their Bay clean-up efforts in the *1987 Chesapeake Bay Agreement*. The *1987 Agreement* included one of the most important and ambitious commitments of the Bay Program:

> *"Develop, adopt, and implement a basin-wide strategy to equitably achieve by the year 2000 at least a 40 percent reduction of nitrogen and phosphorus entering the mainstem of the Chesapeake Bay. The strategy should be based on agreed upon 1985 point source loads and on nonpoint source loads in an average rainfall year."*

This goal is intended to raise oxygen levels in the Bay's waters, which, in turn, will help improve habitats and the health of living resources. The goal was reaffirmed following a reevaluation in 1992, and amended to bring a tributary-specific focus to the nutrient reduction effort, adding the concept of capping the nutrient load at the reduced levels beyond the year 2000.

The 1992 reevaluation yielded an important finding about Virginia's tributaries and their impact on Bay water quality. It was determined that the nutrient loads from the Potomac and basins to the north had the greatest influence on conditions in the Bay, and the loads from the southerly tributaries (Rappahannock, York, James, and Small Coastal Basins) contributed little to the dissolved oxygen deficit of the main stem of the Bay. For this reason, Virginia embarked on a two-pronged approach for our tributary strategies -- a concentrated effort in the Potomac basin to meet the 40 percent goal, and at the same time expanding the monitoring and modeling programs in the lower tributaries to help determine appropriate nutrient reduction goals for each river basin.

The Chesapeake Bay Program has developed several water quality objectives that will be used in the development of strategies for each of Virginia's tributaries. These objectives will provide the primary scientific context in which nutrient reduction goals for each of the tributaries will be established. Water quality model simulations will be the basic technical tool used to help determine the nutrient reduction goals for each tributary.

The Problem of Nutrient and Sediment Pollution in the York River Basin

Water quality in the Chesapeake Bay and its tributary rivers has been adversely impacted by nutrient over-enrichment. This is caused by excessive inputs of nitrogen and phosphorus, which in turn can stimulate unwanted growth of algae. Algal blooms can shade submerged aquatic vegetation (SAV), and without the light needed for growth this important resource has difficulty surviving. If not eaten by higher life forms, the algae eventually sink and are decomposed by bacteria, a process that consumes valuable oxygen needed by fish, shellfish, and other bottom-dwelling aquatic organisms. The sources of these nutrient loads include runoff from urban and agricultural land, and treated discharges from municipal and industrial wastewater facilities.

Over the past twenty-five years, the Chesapeake Bay and its tributaries have been the focus of intensive environmental and ecological study. To understand the complex interactions between the Bay and its living resources, sophisticated computer models have been developed. These studies, which have been verified by years of water quality monitoring in the York River and the entire Bay, have shown that nutrient over-enrichment is a significant water quality problem facing the Bay and its tributaries.

The capacity of the York River to support living resources, including historically valuable fisheries, is seriously affected by high levels of nutrients (nitrogen and phosphorus) and sediments. Excess nutrients in the basin have led to increased algae populations, which can adversely affect fish, oysters, crabs, underwater grasses and other aquatic life. These nutrients come mostly (about 80%) from nonpoint sources, including surface runoff from farms, residential lands and other urban areas, but also from point sources (wastewater treatment and industrial plants).

Another important factor affecting water quality in the York River is the amount of suspended sediment in the water column. High sediment concentrations can block the light needed by SAV, and may upset the feeding patterns of plankton and juvenile fish. When settled, the sediment loads can cover shellfish and the hard substrate that they need for attachment and growth.

Objectives of the York River Basin Tributary Strategy

A primary objective of the York Tributary Strategy is to identify practical, cost-effective and equitable methods to reduce nutrient and sediment loads to target levels (reduction goals) in the York basin. This is done by providing best available information on land uses, nutrient and sediment loads, water quality conditions and management practices to local decision-makers. The strategy then serves as an implementation guide for providing funding for identified nutrient and sediment controls. A second objective is to inform citizens of the factors that affect the quality of their rivers and streams, and the things they can do to help restore these waterways.

The Benefits of Reducing Nutrient and Sediment Loads

Many benefits will accrue to the York River as a result of nutrient and sediment reductions. The two most important are: (1) increasing dissolved oxygen, essential for the survival of all aquatic organisms; and, (2) improving water clarity, necessary for underwater grasses. Increased oxygen levels expand the volume of water available as habitat to aquatic organisms. Nutrient reductions also lead to vast improvements across the food web. Increased oxygen levels and water clarity improve conditions for benthic (river bottom) organisms and small organisms (zooplankton) in the water column which serve as food for fish. Underwater grasses provide habitat for invertebrates and juvenile fish, which also serve as important food for larger fish. The benefits of the nutrient and sediment reduction goals established in the strategy will be verified by continued monitoring, research, and modeling as they are achieved.

Computer Modeling for York Tributary Strategy Development

Much of the technical information that supports the York River Strategy development are from the estimates of nutrient and sediment loading levels for each jurisdiction in the York basin as estimated by the Chesapeake Bay Program Watershed Model (WSM). These numbers include the nutrient loads discharged from point sources in the basin and estimations of nonpoint source loadings of sediments and nutrients from the different types of land uses present. These estimations provide a baseline for understanding status and trends of nutrient and sediment loads, and their relationship to water quality conditions in the York River. The WSM results serve as input to a second computer model, the Water Quality Model (WQM).

The Chesapeake Bay Program Water Quality computer model has been used to help us assess nitrogen, phosphorus and sediment reduction goals for the York basin. The computer model provides tributary-specific water quality model simulations of the environmental benefits expected from varying levels of nutrient reduction. The WQM simulates the affects of nutrient enrichment -- and potential improvements from load reductions -- in the tidal portion of the river basin. The Bay Program has been working for several years on enhancing the portions of the WQM that cover Virginia's southerly tributaries. This was supported by enhanced monitoring that was completed in 1994, and this data was used to calibrate and verify the improved Tributary WQM. Tributary WQM development aided in determining the nutrient reduction goals that are included in the *York Strategy*.

The Bay Program Water Quality model is a state-of-the-science model that has integrated links to other models, including:

- Watershed model;
- Airshed model;
- Hydrodynamic model;
- SAV (underwater grasses) model; and
- Benthic model.

This integrated model is capable of simulating the water quality responses that can result from a wide range of management options. This model provided information on where the most cost-effective nutrient reductions could be made and the benefits associated with these reductions.

The most recent versions of the model now test the Bay's response to not only changes in low dissolved oxygen, but investigate its impact on a variety of living resources such as the critical nursery grounds for many important Bay finfish and shellfish. In addition, it includes not only their habitat but potential food for a number of the Bay's important fishes. These and other aspects of the Tributary Water Quality Model have been useful in determining the level of nutrient and sediment reduction that will be beneficial in the York River basin.

The Shenandoah/Potomac Experience: Lessons Learned

In 1994, Virginia began the development of tributary strategies by instituting a partnership among state government, local governments, interest groups and stakeholders in the Shenandoah and Potomac river basins. At the state level, scientific data and technical assistance was provided to support this process. Local governments were asked to bring their experience to the table and to represent the interests of their constituents in the decision-making involved in the strategy development process. Citizens and other stakeholders were asked to contribute their expertise and innovative thinking on how to devise practical, cost-effective and equitable solutions for reducing nutrient loadings.

We learned much from our local partners in this process. One of the most important messages we heard was that further water quality initiatives in Virginia must not be handed down as unfunded mandates. Local governments, farmers and others across the Shenandoah and Potomac basins stated that all Virginians benefit from cleaner water and that we all should bear some part of the costs for achieving it. As we finalized the Shenandoah and Potomac River Basins Nutrient Reduction Strategy, Governor Allen upheld this local guidance by proposing $11 million for strategy implementation beginning in 1997 and $60 million for the 1998-2000 biennium. Governor Gilmore later substantially increased funding for this effort.

We also learned from our local partners that protecting the quality of their local rivers and streams must be considered to be just as important as protecting downstream waters such as the Chesapeake Bay. Combining this local perspective with the big picture of Bay restoration is a valuable approach to the management of our water quality programs, including monitoring. First, every cleanup effort that is accomplished at the local level will have a positive impact on downstream water quality; and, in fact, we will only achieve restoration of the Chesapeake Bay as a cumulative result of those local and individual actions. Second, our monitoring program must be able to recognize localized areas of water quality concern, as well as portray the overall health of the Bay system. This approach is not for the purpose of pointing fingers, but to assist us in targeting limited resources to areas that will most benefit from them.

Water Quality Improvement Act Fund

The purpose of the Virginia Water Quality Improvement Act of 1997 (Act) is to restore and improve the quality of state waters and to protect them from the impairment and destruction for the benefit of current and future citizens of the Commonwealth (Section 10.1-2118 of the Code of Virginia). Because this is a shared responsibility among state and local governments and individuals, the Act also created the Water Quality Improvement Fund (Fund). The purpose of the Fund is to provide Water Quality Improvement Grants to local governments, Soil and Water Conservation Districts and individuals for point and nonpoint source pollution prevention, reduction and control programs....(Section 10.1-2128 of the Code of Virginia). The Department of Environmental Quality has the responsibility of providing technical and financial assistance to local governments and individuals for the control of point source pollution. The Department of Conservation and Recreation (DCR) has the responsibility of providing technical and financial assistance to local governments, soil and water conservation districts, and individuals for nonpoint source pollution prevention, reduction and control programs.

A primary objective of the Fund is to reduce the flow of excess nutrients to the Chesapeake Bay through the implementation of the Bay Tributary Strategies. The 1998 Virginia General Assembly provided funding for the 1998-2000 biennium through the general appropriation act for all three regions of the state. These include the Shenandoah-Potomac Basin, lower Bay tributaries, and Southern Rivers. Funds totaling $3.5 million were appropriated for the lower Bay tributaries (York, James and Rappahannock Rivers) for the purpose of implementing the tributary strategies. The funds were divided between the Virginia Agricultural Best Management Practice Cost-Share Program ($2.5 million) and water quality improvement projects ($1.0 million). The General Assembly also directed that monies deposited in the Fund in excess of the $16.75 million total appropriation shall be used by DCR to implement adopted strategies for nutrient reduction in the Rappahannock, York, and James Rivers and the eastern and western basins. These allocations have since increased. Governor Gilmore's FY00 budget amendments included an additional $34.7 million dollars for the Fund. Of the latter amount, nearly $27 million was added to the original allocations for the lower Bay tributaries: $24.8 million more for point sources; $1.25 million more for cost-share, and $750,000 more for water quality improvement projects.

Competitive grants are awarded for water quality improvement projects for the lower Bay tributaries. These projects should focus on implementing components of the tributary strategies. A ranking of projects is now established annually based on criteria as outlined in each grant application. Nutrient reduction potential and cost effectiveness will continue to have priority.

For point source projects, all of the funds were previously targeted to facilities located in the Shenandoah-Potomac Basin in order to meet the Commonwealth's commitment to achieve a nutrient reduction of 40% by the year 2000. The General Assembly appropriated approximately $37 million for point source projects during the 1998-2000 biennium. Point source projects in the other Bay tributaries can also qualify for cost-share.

For further information on the Fund please refer to the *Annual Report on the Virginia Water Quality Improvement Fund Nonpoint Source Program, Senate Document no.21.*

II. YORK RIVER BASIN WATER QUALITY AND LIVING RESOURCES

BASIN OVERVIEW

The York River basin lies in the central and eastern section of Virginia and covers 2,662 square miles or approximately 7% of the Commonwealth's total land area. The basin is bounded by the Rappahannock River basin to the north and the James River basin to the south. The headwaters of the York River are located in Orange County and the river flows in a southeasterly direction for approximately 220 miles to its mouth at the Chesapeake Bay. The basin's width varies from five miles at the mouth to 40 miles at its headwaters. The basin is comprised of the York River and its two major tributaries, the Pamunkey and the Mattaponi. The York River proper is only about 30 miles in length. The Pamunkey River's major tributaries include the North and South Anna Rivers and the Little River; while the major Mattaponi tributaries are the Matta, the Po, and the Ni Rivers.

Lying in the Coastal Plain and Piedmont physiographic provinces, the basin's topography is characterized by rolling hills in the extreme western portion of the basin in and around the headwaters, to gently sloping hills and flat farmland near its mouth. Tributaries in the central Piedmont exhibit moderate and near constant profiles. Streams in the Coastal Plain are characterized by their flat slope. The York watershed's relatively low overall gradient, compared to the other Virginia basins, scientists believe, implies that aggressive implementation of nonpoint source BMPs may be a particularly useful strategy in this basin for nutrient and sediment load reduction by increasing average residence times for treatment.

The climate of the basin is moderate. The average annual temperature is 57° F. The average annual precipitation is approximately 43 inches. Annual rainfall varies little throughout the basin, averaging between 42 to 46 inches. The average annual snowfall is light, ranging from 10 inches along the coastal portion to 15 inches in the upper Piedmont area. The majority of the watershed is positioned in the Coastal Plain and it does not include Piedmont areas as far west as the Rappahannock and James watersheds. This results in the potential for different responses to major storm events among the watersheds, depending on the track of these storm events.

The hydrodynamic processes in the York system (York proper) are somewhat greater than the Rappahannock but less than the James. In the York, this means that physical processes are relatively large, and there is evidence that these processes are a major factor in controlling living resource conditions in the middle tidal reaches of the system.
While the York watershed generally compares favorably with the other Virginia tributaries in terms of total sediment and nutrient loads, this should not be taken to imply there are no significant opportunities for improvements in living resources based on further reductions in nutrients and sediments. On the contrary, scientists have hypothesized that the York system may still be at a point in overall system degradation where a unit improvement in loads might be expected to produce a relatively larger improvement in habitat suitability compared to other systems.

The York River (and Western Coastal) basin includes all or parts of seventeen counties: Albemarle, Fluvanna, Goochland, Louisa, Orange, Spotsylvania, Caroline, Hanover, Essex, Gloucester, James City, King and Queen, King William, Mathews, Middlesex, New Kent, and York. The 1994 population for the York River basin was approximately 250,332 people. The majority of this population still lives in largely rural settings and is generally evenly distributed throughout the basin. Currently no major cities are contained within the basin; however, growth from the Fredericksburg, Richmond, and Hampton Roads metropolitan areas is spilling into the basin.

York Watershed Land Uses and Loads

The York Basin is still a relatively undeveloped watershed as reflected in the land use breakdowns for the system. The basin as a whole is still 65-72% forested. In descending order the next largest land uses include agriculture crops 20%, agriculture other (pasture and operations that generate animal waste), and urban land at 10%.

The total load of nutrients and sediments that enter the York River and its tributaries comes from either point sources (nutrients discharged from municipal wastewater treatment or private industrial plants) or nonpoint sources. The two major categories of nonpoint sources are runoff from agricultural land and runoff from urban land.

The numbers provided in the strategy for nutrient and sediment loadings are based on the Chesapeake Bay Program's Watershed Model. The Watershed Model uses information on the land use coverage of the 64,000 square mile Bay drainage area to compute nitrogen, phosphorus, and sediment runoff from the land. It then inputs the loads discharged by wastewater treatment plants and delivers the total load to the Bay. The Watershed Model relies on weather data, land use data, soil and geophysical data, and point source load estimates to calculate the total nutrient and sediment load reaching the Bay.

The Bay Program participants established the year 1985 as the baseline from which all nutrient and sediment reductions, occurring due to the implementation of Best Management Practices (BMPs), would be calculated. The baseline nutrient load is the sum of 1985 point source discharges and the nonpoint nutrient runoff associated with 1985 land uses in the York River basin, calculated for an average rainfall year. Estimates of nutrient and sediment loads calculated by the Chesapeake Bay Program Watershed Model are designed to provide data that is unaffected by yearly changes in rainfall. Based on data for land use, loading rates/acre, population density, point source loads and transport factors, the Watershed model has calculated total estimated nutrient and sediment loads to the York River for 1985 and 1996. In addition, the model has been used to calculate the relative point source loads and nonpoint source loads from major types of land use, for the basin as a whole and for each of the three regions within the basin. These loads have also been broken out for each of the 12 counties in the basin. Watershed model nutrient loading charts for the basin as a whole, for each of the three assessment regions and the Coastal basins, are provided in the following pages for the years 1985 and 1996.

Not all of the nutrients entering the Bay are considered controllable. The nonpoint source loads that naturally come from forested areas in the basin are not considered to be part of the controllable fractions. The remaining nutrients, both point and nonpoint in origin, that enter the Bay are considered controllable to some degree and are amenable to nutrient reduction practices. The charts that follow represent loading fractions which are considered to be controllable for the purposes of strategy development and calculations of potential reductions.

Changes from 1985 - 1996 Nitrogen Loads by Source

York River Basin

Controllable Loads

1985 1996 Change

	1985	1996	Change	
Agriculture - Crops	3,757,630 lbs.	3,602,728 lbs.	-154,902 lbs.	-4%
Agriculture - Other	463,568 lbs.	430,041 lbs.	-33,527 lbs.	-7%
Urban	578,770 lbs.	707,586 lbs.	+128,816 lbs.	+22%
Septic	355,736 lbs.	471,818 lbs.	+116,082 lbs.	+33%
Point Source	1,292,932 lbs.	1,594,488 lbs.	+301,381 lbs.	+23%
TOTAL	**6,448,636 lbs**	**6,806,488 lbs.**	**+357,852 lbs.**	**+6%**

Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.

Agriculture - other includes pasture and operations that generate animal waste.
These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

Changes from 1985 - 1996 Phosphorus Loads by Source

York River Basin

Controllable Loads

	1985	1996	Change	
Agriculture - Crops	341,225 lbs.	325,977 lbs.	-15,248 lbs.	-5%
Agriculture - Other	24,568 lbs.	18,811 lbs.	-5,757 lbs.	-23%
Urban	40,523 lbs.	49,552 lbs.	+9,029 lbs.	+23%
Point Source	417,202 lbs.	181,012 lbs.	-236,190 lbs.	-57%
TOTAL	**823,518 lbs**	**575,352 lbs.**	**-248,166 lbs.**	**-30%**

Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.

Agriculture - other includes pasture and operations that generate animal waste.
These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

Changes from 1985 - 1996 Sediment Loads by Source

York River Basin

Controllable Loads in tons

1985 1996 Change

Agriculture - Crops	136,799 tons	131,041 tons	- 5,758 tons	- 4%
Agriculture - Other	8,919 tons	9,299 tons	+ 380 tons	+41%
Urban	2,111 tons	2,587 tons	+ 476 tons	+23%
TOTAL	**147,829 tons**	**142,927 tons**	**- 4,902 tons**	**- 3%**

Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.

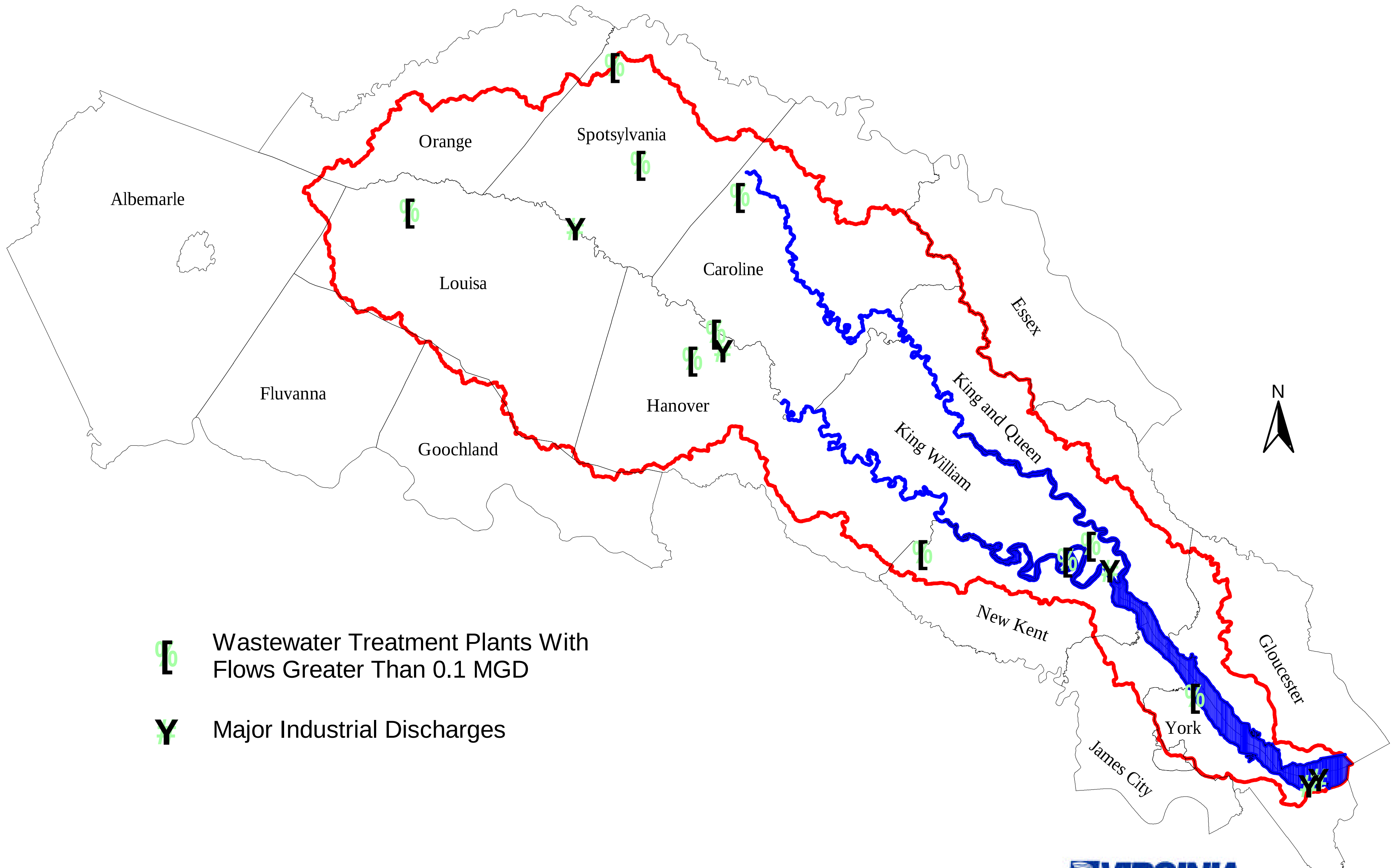
Agriculture - other includes only pasture because animal waste does not contribute sediment loading.
These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

The York Basin includes two major industrial point sources and six major municipal sewerage treatment plants that contribute nitrogen and phosphorus to the system. See map on the next page for a plot of the major and minor municipal and industrial dischargers in the York Basin. Appendix B contains the complete list of permitted discharges in the York basin.

The York basin includes 27 hydrologic units, delineated for purposes of watershed management and water quality planning. The nonpoint source pollution potential assessment performed by the Department of Conservation and Recreation (part of the 1998 305(b) report) resulted in the following rankings of the 27 waterbodies:

- Two (F01 and F10) have a high potential for pollution from animal operations;
- Five (F01, F08, F09, F12, and F16) have a high potential for pollution from forest land use activities;
- Six (F04, F12, F15, F20, F26, and F27) have a high potential for pollution from urban land use; and
- Two (F20 and F27) are listed by the state as being in the top 100 high priority watersheds for overall potential for nonpoint source pollution.

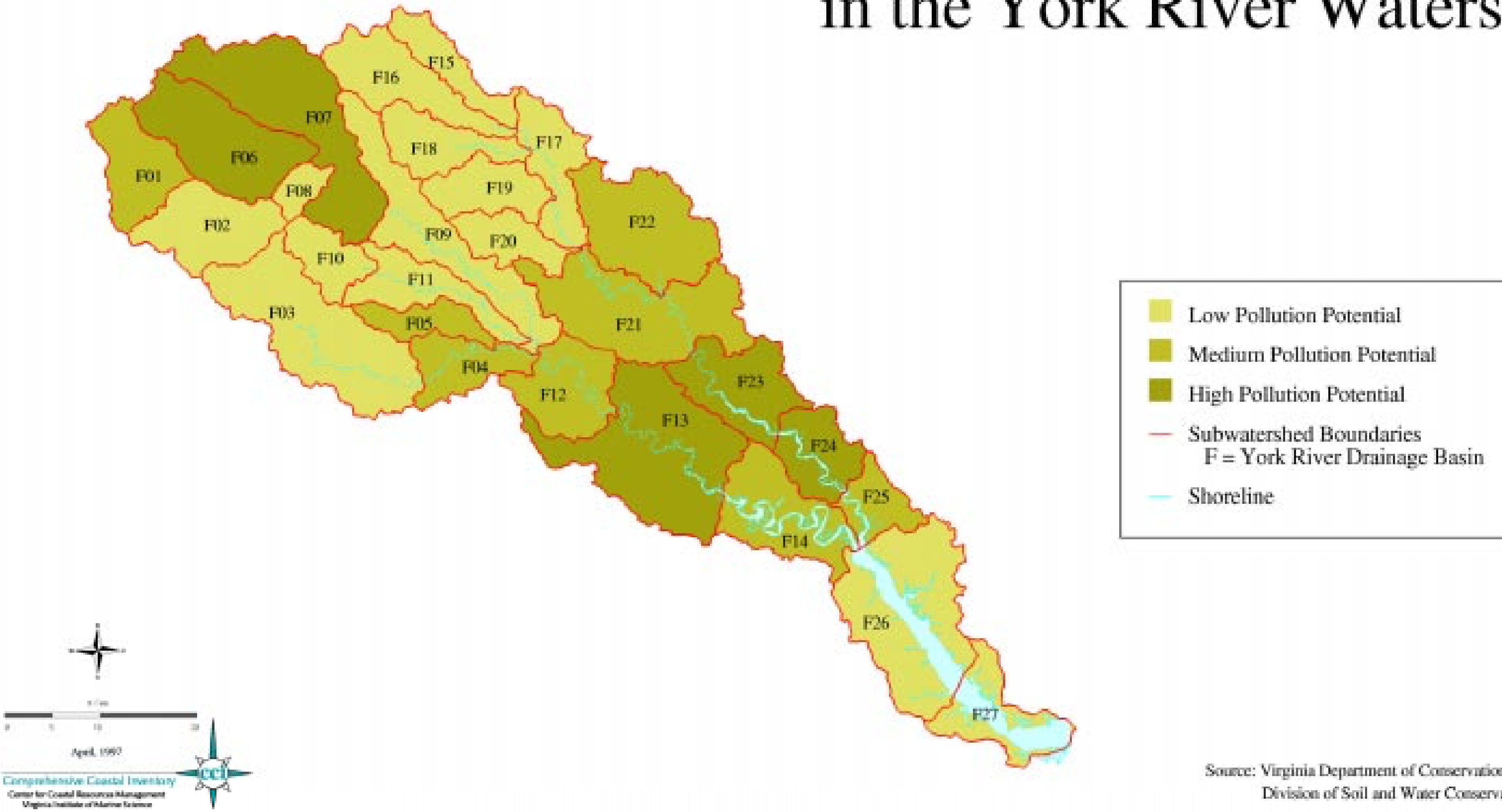
York River Watershed



VIRGINIA ECONOMIC DEVELOPMENT PARTNERSHIP

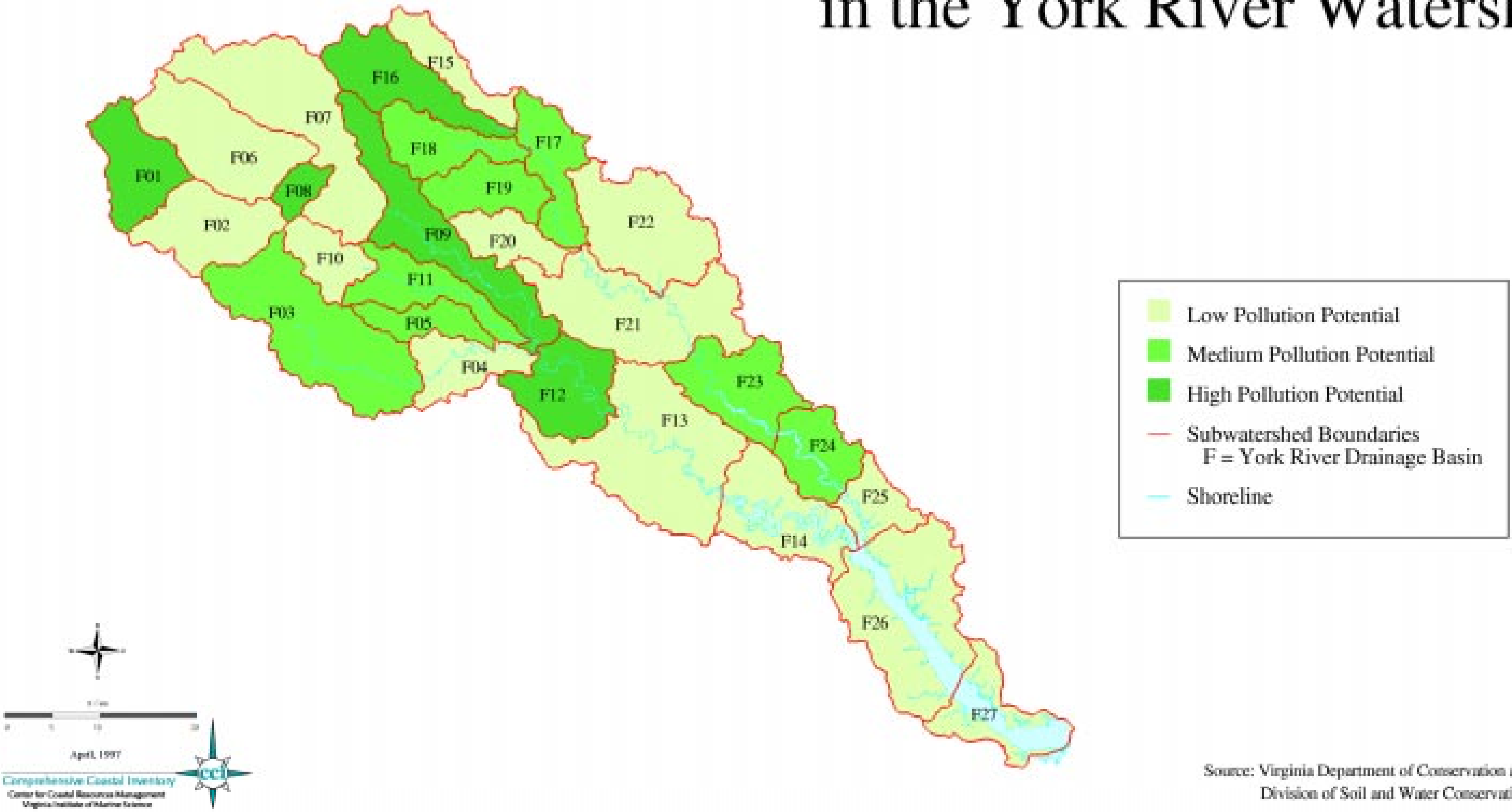
September 1999
Source: Department of Environmental Quality

Pollution Potential Ratings for Agricultural Lands in the York River Watershed



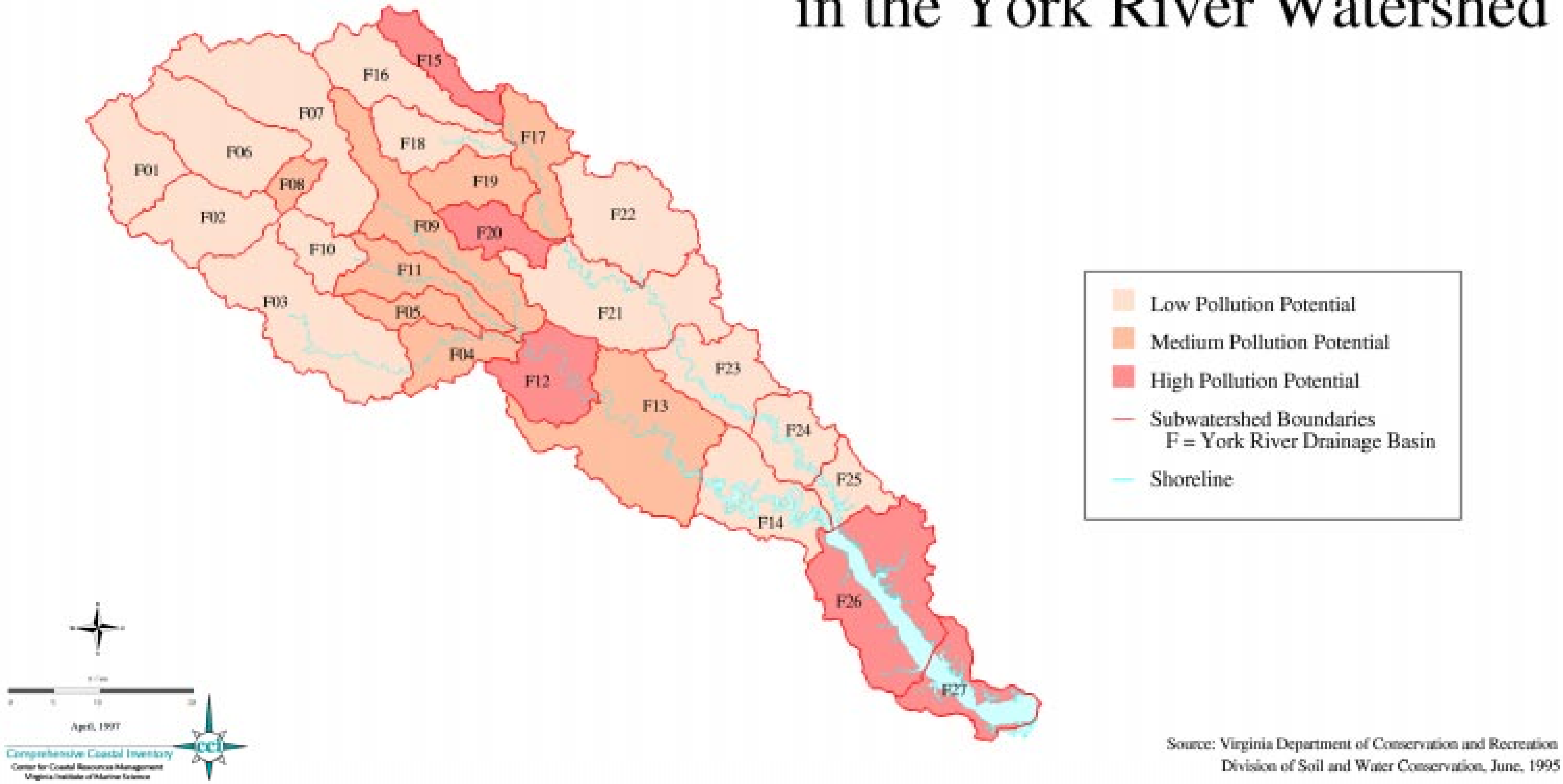
Source: Virginia Department of Conservation and Recreation
Division of Soil and Water Conservation, June, 1995

Pollution Potential Ratings for Forested Lands in the York River Watershed

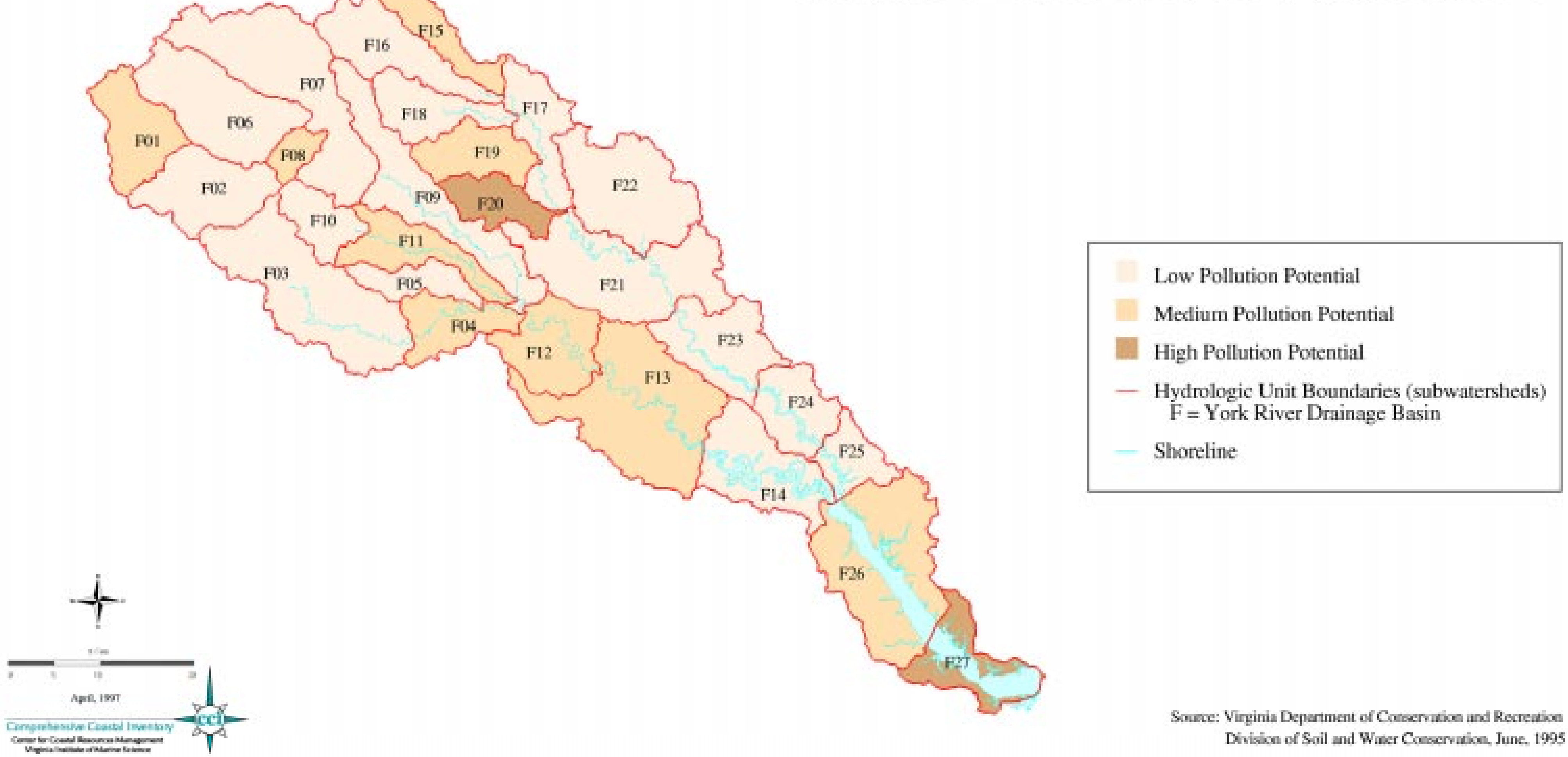


Source: Virginia Department of Conservation and Recreation
Division of Soil and Water Conservation, June, 1995

Pollution Potential Ratings for Urban Regions in the York River Watershed



Pollution Potential Ratings for Non–Point Sources in the York River Watershed



Upper York Region

For the purposes of this analysis, the upper York region includes the following localities: part of Albemarle County (5,300 acres), part of Fluvanna County (720 acres), part of Goochland County (8,000 acres), Louisa County, part of Orange County (85,850 acres), and part of Spotsylvania County (202,000 acres). These acres have been rounded, actual acres are shown in local tables. The watershed also includes the Tri-County City, Culpeper, and Thomas Jefferson Soil and Water Conservation Districts.

The only point source for nutrients in the upper York is the Gordonsville STP. Two new plants may come on line in Spotsylvania County and one in Louisa County between 2000 and 2010.

Facility	AVG Flow (mgd)	TN Conc (mg/l)	TN Discharged (lbs/yr)
Gordonsville STP	1985- .55	18.70	31,309
	1996- .75	18.70	42,694

Facility	AVG Flow (mdg)	TP Conc (mg/l)	TP Discharged (lbs/yr)
Gordonsville STP	1985- .55	6.40	10,715
	1996- .75	2.50	5,708

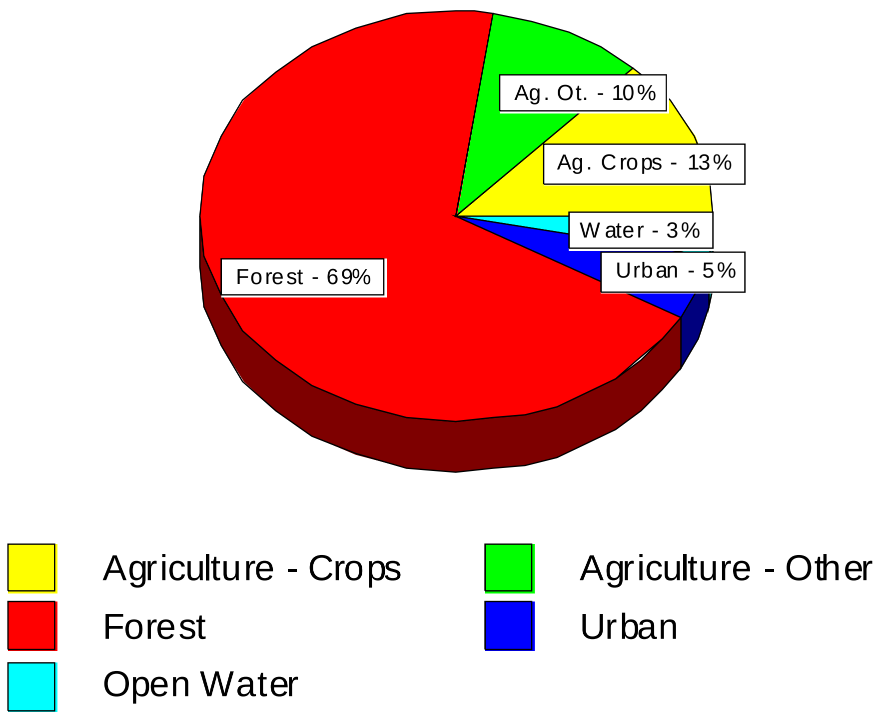
This region contains the following HUP subwatersheds F1 through F3, F5 through F11, and F16 through F19. The region is dominated by agricultural and forestal land uses but is seeing some urbanization pressure from the Northern Virginia area. The region's agriculture has a significant animal component, largely dairy and cattle. Due to this fact, subwatershed units F01 and F10 have a high potential for pollution from animal operations. Subwatershed units F01, F08, F09 and F16 are rated as having high pollution potential from active forestry activities within their boundaries.

DEQ has listed four stream segments in this region as being impaired by high fecal coliform levels. These segments include Terry's Run (Orange Co.), Mountain Run (Orange Co.), Pamunkey Creek (Orange Co.), and Plentiful Creek (Spotsylvania Co.). The source of the fecal coliform could be from animal operations in the area or some other as yet undetermined source.

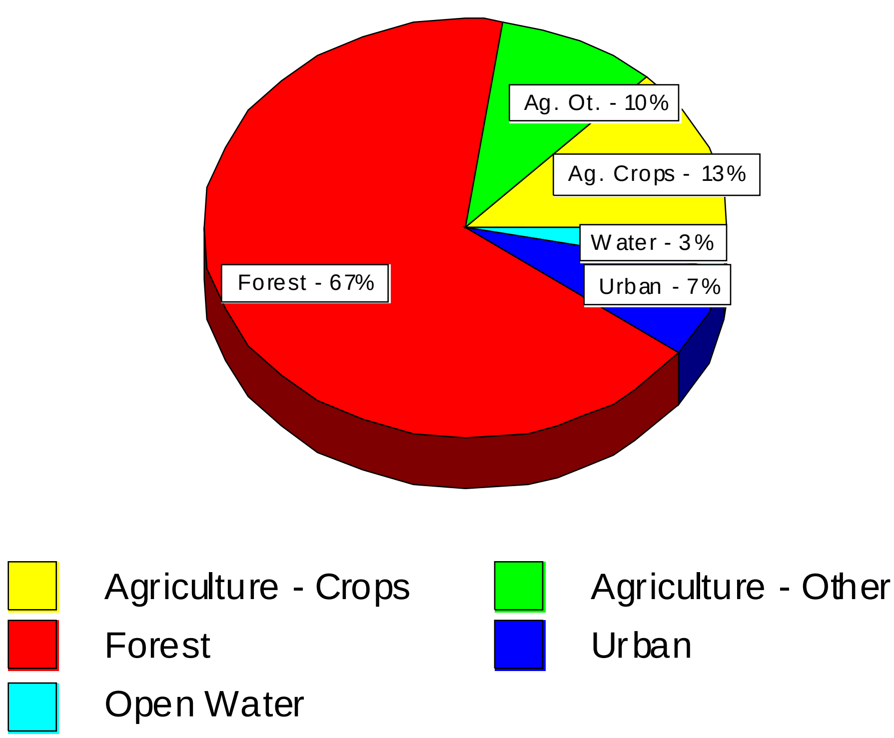
Land use breakdowns in the upper York are similar to the watershed as a whole. This is true for both the base year of 1985 and progress year of 1996. Forest is the dominant use at 69% in 1985 and 67% in 1996. The next largest use is agricultural crops at 13% for both years and other agriculture at 10% for both years. Urban land is a relatively small use in this part of the watershed at 5% in 1985 and 7% in 1996. In comparing the land uses of the two years, urban land has increased and forest land decreased while the agricultural uses remained constant.Loadings are derived from these land uses. For the purposes of this discussion, only controllable loads are discussed.

Nitrogen. In the base year of 1985, agricultural crops were the largest contributor of controllable nitrogen loads

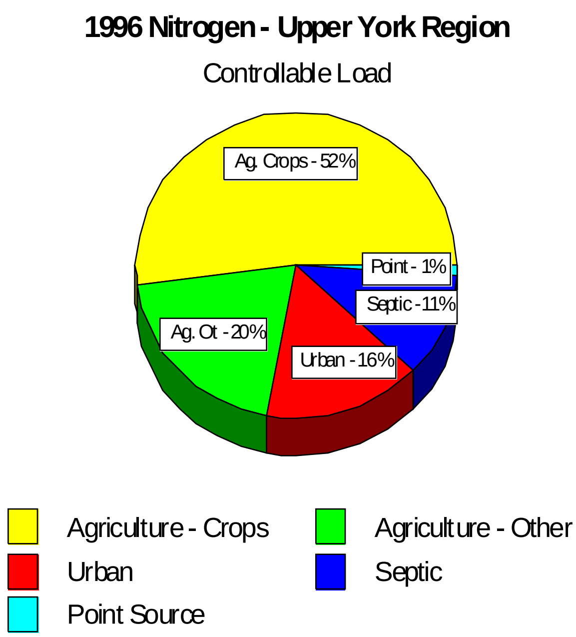
1985 Land Use - Upper York Region

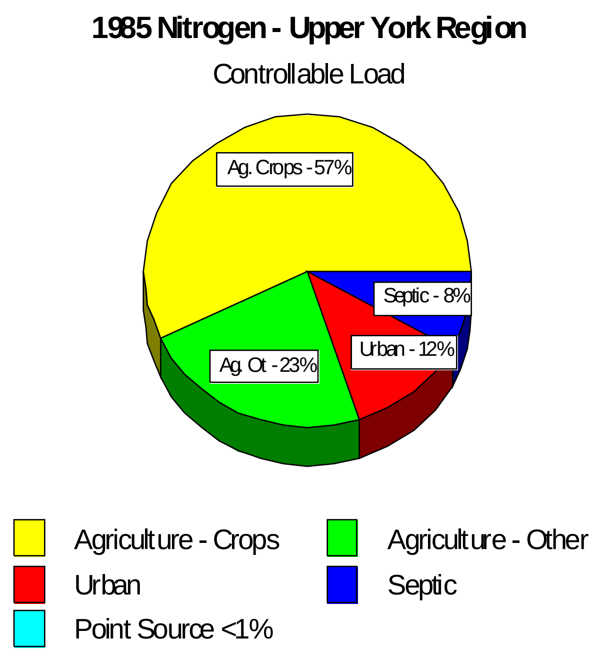


1996 Land Use - Upper York Region



at 57% in the upper York. Other agriculture (animal waste generators and pasture) accounted for another 23% of the nitrogen load. Urban runoff loads amounted to 12%, while septic nitrogen loads accounted for 8%. With the increases in urbanization between 1985 and 1996, nitrogen loadings increased from urban sources to 16% from runoff, 11% from septic, and 1% from point sources. Agriculture loads declined modestly but remained the dominant source of nitrogen in the region. These decreases in the agricultural loads are probably due to the implementation of agricultural best management practices.





Changes from 1985 - 1996 Nitrogen Loads by Source

Upper York Region

Controllable Loads

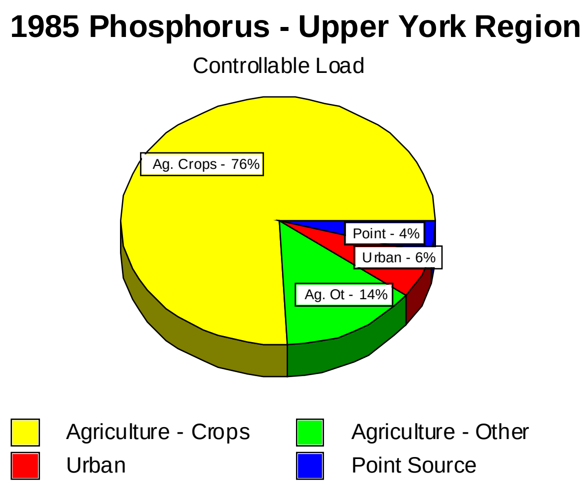
	1985	1996	Change	
Agriculture - Crops	353,137 lbs.	322,477 lbs.	-30,660 lbs. -9%	
Agriculture - Other	143,809 lbs.	125,364 lbs.	-18,445 lbs. -13%	
Urban	73,737 lbs.	98,877 lbs.	+25,140 lbs. +34%	
Septic	48,578 lbs.	66,628 lbs.	+18,050 lbs. +37%	
Point Source	2,163 lbs.	2,973lbs.	+810lbs. -37%	
TOTAL	**621,424 lbs**	**616,320 lbs.**	**-5,104lbs.**	**-<1%**

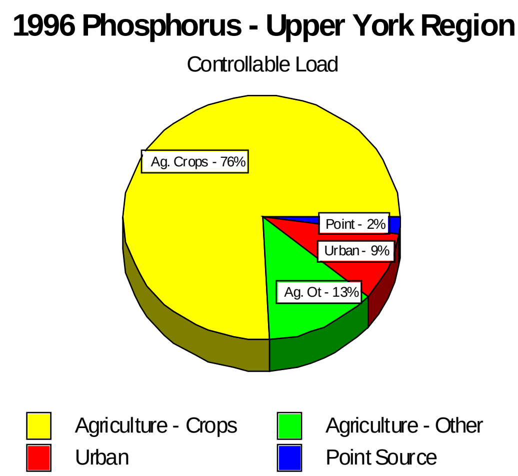
Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.

Agriculture - other includes pasture and animal waste generators.

These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

Phosphorous. In the base year of 1985, agricultural crops were the largest contributor of controllable phosphorus loads at 76% in the upper York. Other agriculture (animal waste generators and pasture) accounted for another 14% of the phosphorous load. Urban runoff loads amounted to 6% and point source loads 4%. With the increases in urbanization between 1985 and 1996, phosphorous loadings increased from urban sources to 9% from runoff. Point source loads decreased due to the Phosphate detergent ban and operational changes.





Changes from 1985 - 1996 Phosphorus Loads by Source

Upper York Region

Controllable Loads

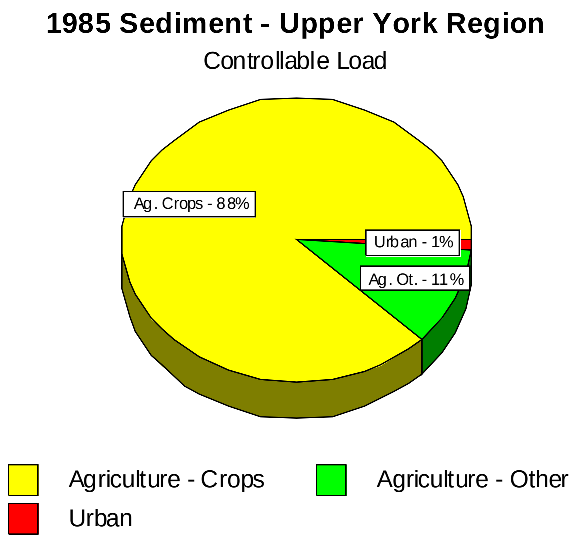
	1985	1996	Change	
Agriculture - Crops	67,437 lbs.	60,432 lbs.	-7,005 lbs.	-10%
Agriculture - Other	12,335 lbs.	10,673 lbs.	-1,662 lbs.	-14%
Urban	5,053 lbs.	6,861 lbs.	+1,808 lbs.	+36 %
Point Source	3,629 lbs.	1,949 lbs.	- 1,680 lbs.	-46%
TOTAL	**88,454 lbs.**	**79,915 lbs.**	**-8,539 lbs.**	**-10%**

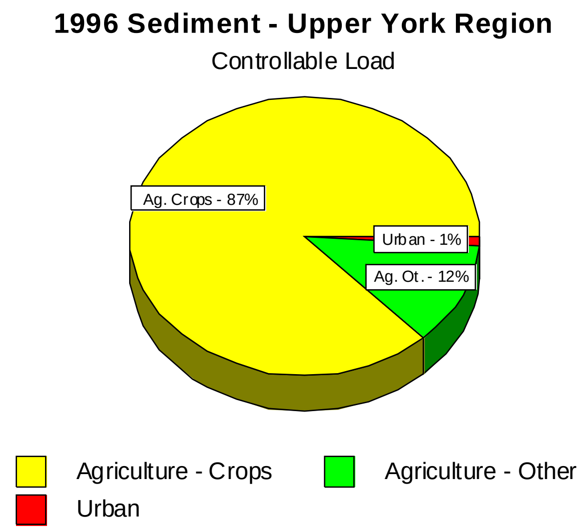
Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.

Agriculture - other includes pasture and animal waste generators.

These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

Sediment. In the base year of 1985, agricultural crops were the largest contributor of controllable sediment loads at 88% in the upper York. Other agriculture (animal waste generators and pasture) accounted for another 11% of the sediment load. Urban runoff loads amounted to 1%. By 1996, percentage of the controllable sediment load decreased to 87% for crops and increased to 12% for other agriculture while the controllable urban fraction remained the same.





Changes from 1985 - 1996 Sediment Loads by Source

Upper York Region

Controllable Loads in tons

	1985	1996	Change	
Agriculture - Crops	47,648 tons	41,460 tons	-6,188tons	-13%
Agriculture - Other	5,756 tons	5,764 tons	+8 tons	+<1%
Urban	484 tons	599 tons	+ 115 tons	+24%
TOTAL	**53,888 tons**	**47,823 tons**	**-6,065 tons**	**-11%**

Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.

Agriculture - other includes only pasture because animal waste does not contribute sediment loading.

These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

Central York Region

For the purposes of this analysis, the central York region includes the following localities: part of Caroline County (265,400 acres), and part of Hanover County (259,100 acres). The regional watershed also includes the Hanover-Caroline Soil and Water Conservation District.

Point sources in the central York include the Ashland STP, the Doswell STP (a combination of municipal discharge from Doswell and industrial discharge from Bear Island Paper), and the Caroline County Regional STP. A new plant in Hanover County is expected to come on line in either 2002 or 2003.

Facility	Avg. Flow (MGD)	TN Conc (MG/L)	TN Discharged (LBS/YR)
Caroline Co. STP	1985- 0	0	0
	1996- .15	18.70	8,539
Ashland STP	1985- .86	13.39	35,054
	1996- 1.23	18.70	70,017
Doswell STP	1985- 2.24	9.60	65,548
	1996- 3.60	9.60	105,204

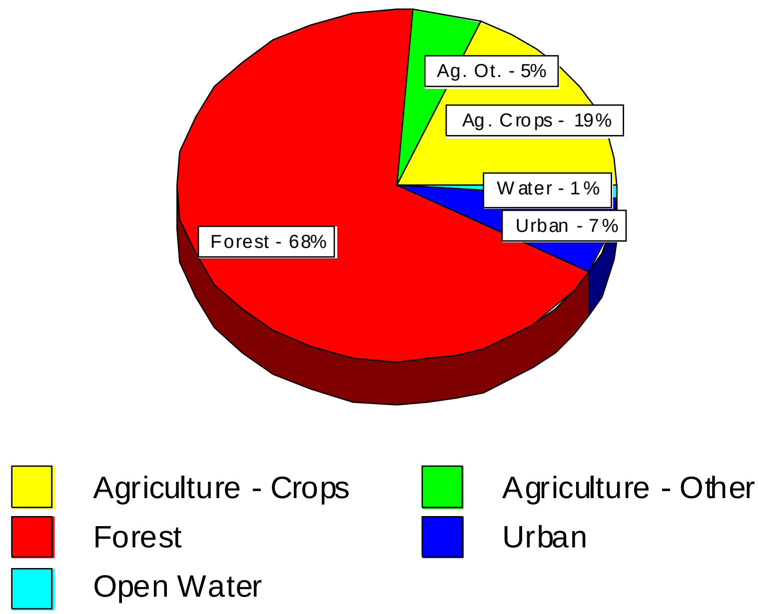
Facility	Avg. Flow (MGD)	TP Conc (MG/L)	TP Discharged (LBS/YR)
Caroline Co. STP	1985- 0	0	0
	1996- .15	2.50	1,142
Ashland STP	1985- .86	4.70	12,304
	1996- 1.23	2.50	9,361
Doswell STP	1985- 2.24	2.89	19,733
	1996- 3.60	2.15	23,561

This region contains the following HUP subwatersheds: F3 through F5, F9, F11 through F13, and F15 through F22. While agriculture and forestry are still significant uses in this region, urbanization is increasing as growth moves in around Ashland and up from the Richmond metropolitan area. Subwatersheds F09 and F12 have a high potential for pollution from forestry land uses. Some of this may be forestry in anticipation of residential development. Subwatersheds F04, F12, F15, and F20 demonstrate high potential from urban land uses, reflecting the growth pressure in this region. Subwatershed F20 is considered a top 100 priority for reducing nonpoint source pollution.

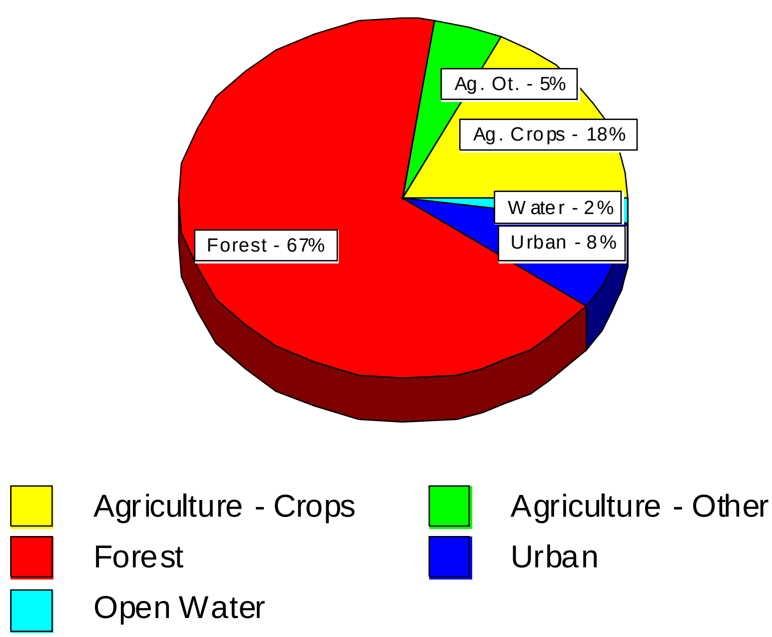
DEQ has listed three stream segments in Hanover County as impaired by fecal coliform. These streams are the South Anna River (between Ashland and the Pamunkey River), Mechumps Creek, and Matadequin Creek.

Land use breakdowns in the central York are also similar to the watershed as a whole. This is true for both the base year of 1985 and progress year of 1996. Forest is the dominant use at 68% in 1985 and 67% in 1996. The next largest use is agricultural crops at 19% for 1985 and 18% for 1996 and other agriculture at 5% for both years. Urban land is a relatively small use in this part of the watershed at 7% in 1985 and 8% in 1996. In comparing the land uses of the two years, urban land increased, while forest land and agricultural crops decreased.

1985 Land Use - Central York Region



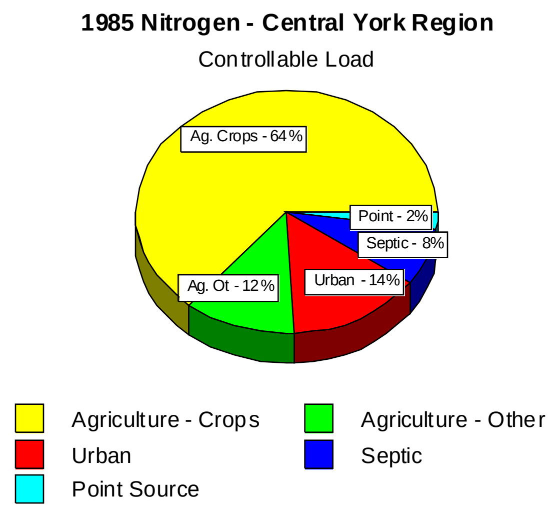
1996 Land Use - Central York Region

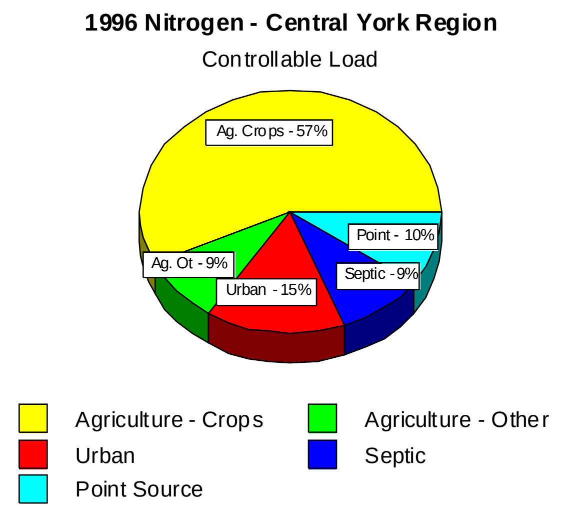


Loadings are derived from these land uses. For the purposes of this discussion, only controllable loads are discussed.

Nitrogen. In the base year of 1985, agricultural crops were the largest contributor of controllable nitrogen loads at 64% in the central York. Other agriculture (animal waste acres and pasture) accounted for another 12% of the nitrogen load. Urban runoff loads amounted to 14%, while septic nitrogen loads accounted for 8% and point sources for 2%. With the increases in urbanization between 1985 and 1996, nitrogen loadings increased from urban sources to 15% from runoff, 9% from septic, and 10% from point sources. Agriculture loads declined but remained the dominant source of nitrogen in the region. These decreases in the controllable agricultural loads are probably due to the increase in urbanization.

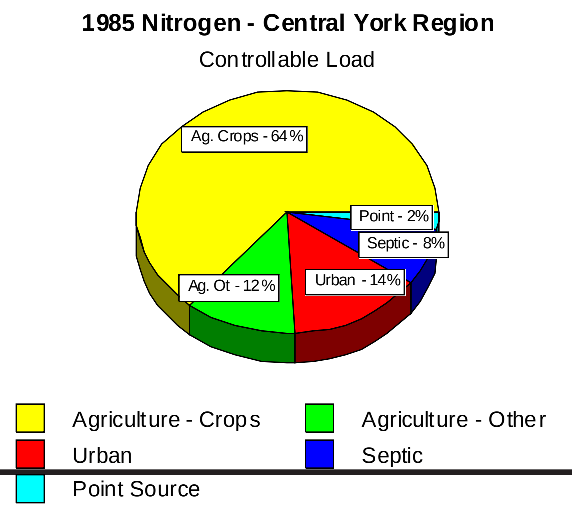
Nitrogen. In the base year of 1985, agricultural crops were the largest contributor of controllable nitrogen loads at 64% in the central York. Other agriculture (animal waste acres and pasture) accounted for another 12% of the nitrogen load. Urban runoff loads amounted to 14%, while septic nitrogen loads accounted for 8% and point sources for 2%. With the increases in urbanization between 1985 and 1996, nitrogen loadings increased from urban sources to 15% from runoff, 9% from septic, and 10% from point sources. Agriculture loads declined but remained the dominant source of nitrogen in the region. These decreases in the controllable agricultural loads are probably due to the increase in urbanization.

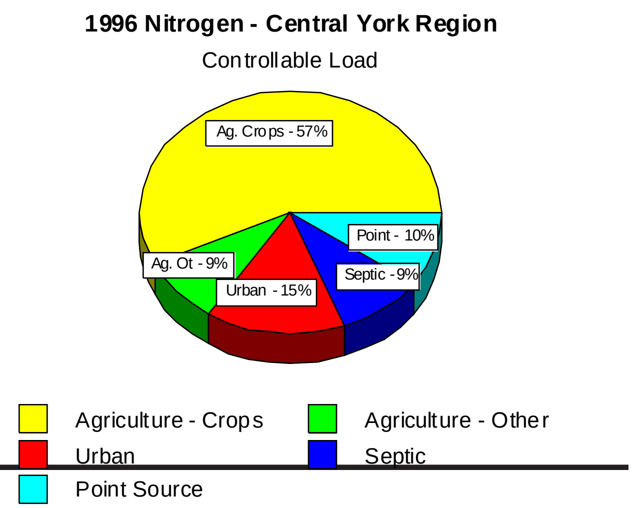




	1985	1996	Change
Agriculture - Crops	830,654 lbs.	875,924 lbs.	+45,268 lbs. +6%
Agriculture - Other	155,317 lbs.	131,189 lbs.	-24,128 lbs. -16%
Urban	185,838 lbs.	236,747 lbs.	+50,909 lbs. +27%
Septic	102,090 lbs.	131,091 lbs.	+29,001 lbs. +28%
Point Source	27,753 lbs.	151,958 lbs.	+124,205 lbs. +448%
TOTAL	**1,301,652 lbs**	**1,526,909 lbs.**	**+225,257 lbs. +17%**

Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.
Agriculture - other includes pasture and animal waste generators.
These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.





Changes from 1985 - 1996 Nitrogen Loads by Source

Central York Region

Controllable Loads

Phosphorous. In the base year of 1985, agricultural crops were the largest contributor of controllable phosphorus loads at 79% in the central York. Other agriculture (animal waste acres and pasture) accounted for another 5% of the phosphorous load. Urban runoff loads amounted to 11% and point source loads 5%. With the increases in urbanization between 1985 and 1996, phosphorous loadings increased from urban sources to 12% from runoff. Point source loads increased to 11% as flows increased. In the central York region, decreases

Changes from 1985 - 1996 Phosphorus Loads by Source

Central York Region

Controllable Loads

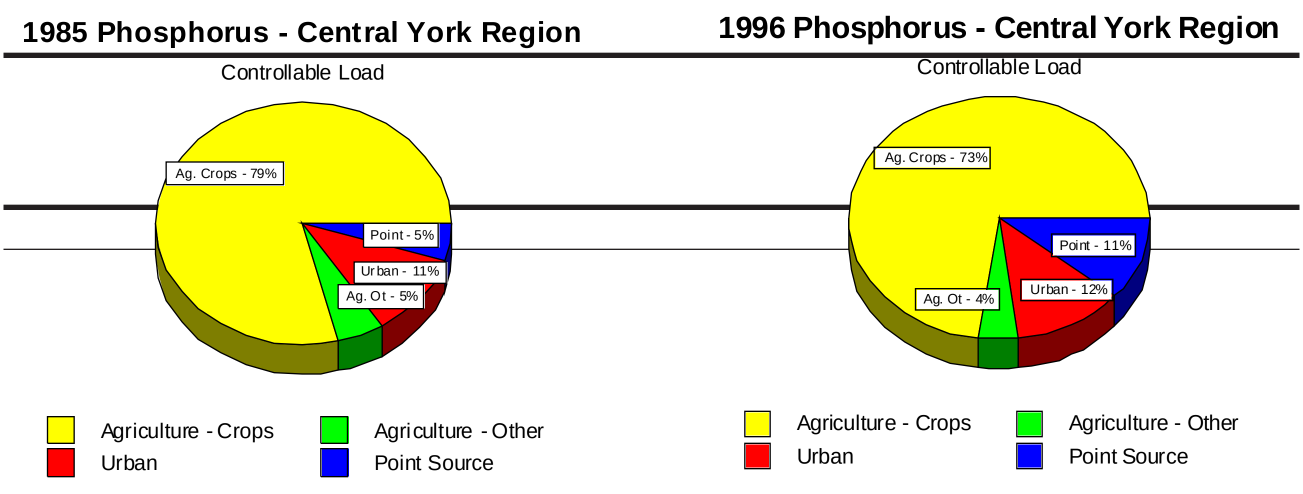
	1985	1996	Change	
Agriculture - Crops	91,356 lbs.	97,810 lbs.	+6,454 lbs.	+7%
Agriculture - Other	5,974 lbs.	4,439 lbs.	-1,535 lbs.	-26%
Urban	12,894 lbs.	16,392 lbs.	+3,498 lbs.	+27 %
Point Source	5,032 lbs.	14,830 lbs.	+9,798 lbs.	+195%
TOTAL	**115,256 lbs.**	**133,471 lbs.**	**+18,215 lbs.**	**+16%**

point sources seen elsewhere due to the Phosphate detergent ban and operational changes were overwhelmed by increases in flow.

Notes: <u>Agriculture - crops</u> includes conservation tillage and conventional tillage as well as hayland.
<u>Agriculture - other</u> includes pasture and animal waste generators.

These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

Sediment. In the base year of 1985, agricultural crops were the largest contributor of controllable sediment loads at 94% in the central York. Other agriculture (animal waste acres and pasture) accounted for another 5% of the sediment load. Urban runoff loads amounted to 1%. By 1996, the percentage of the controllable sediment load for crops remained constant and decreased to 4% for other agriculture while the controllable urban fraction increased to 2%.



Changes from 1985 - 1996 Sediment Loads by Source

Central York Region

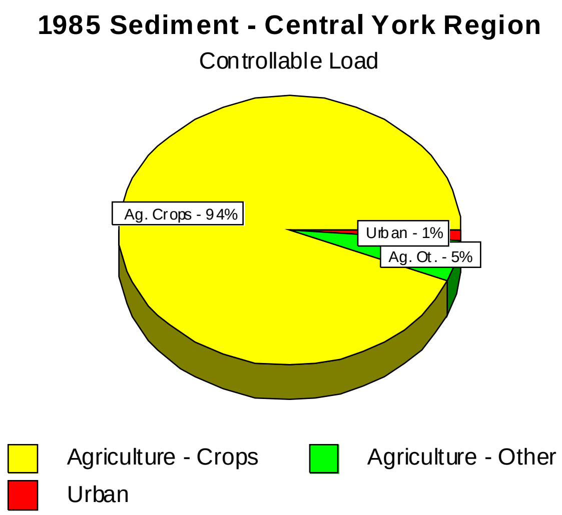
Controllable Loads in tons

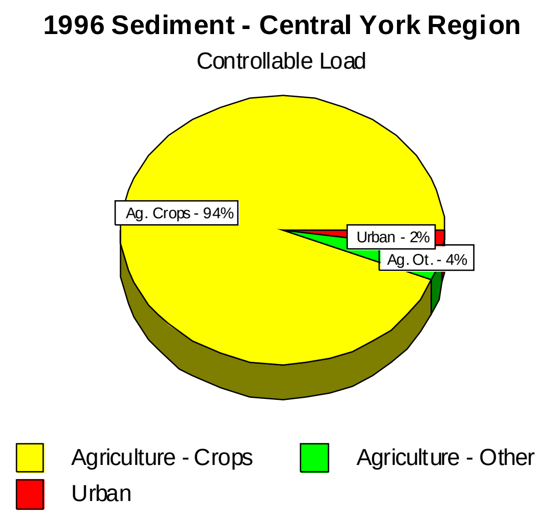
1985	1996	Change

Agriculture - Crops	38,315 tons	45,382 tons	+7,067 tons	+18%
Agriculture - Other	2,118 tons	2,077 tons	- 41 tons	-2%
Urban	494 tons	668 tons	+ 174 tons	+35%
TOTAL	**40,927 tons**	**48,127 tons**	**+7,200 tons**	**+18%**

Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.
Agriculture - other includes only pasture because animal waste does not contribute sediment loading.

These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.





Lower York Region

For the purposes of this analysis, the lower York region includes the following localities: part of Essex County (1,400 acres), part of Gloucester County (48,700 acres), part of James City County (23,000 acres), part of King and Queen County (157,000 acres), King William County (177,400 acres), part of New Kent County (64,000 acres), and part of York County (42,000 acres). The regional watershed also includes parts of the Three Rivers, Tidewater, and Colonial Soil and Water Conservation Districts.

Point sources in the lower York include the West Point STP, the HRSD - York STP, the Saint Laurent Paper Company and the BP-Amoco Yorktown Refinery.

Facility	Avg. Flow (mgd)	TN Conc (mg/l)	TN Discharged (lbs/yr)
BP-Amoco Yorktown	1985- 1.43	36.24	157,755
	1996- 64.68	58	114,198
St. Laurent Paper	1985- 13.68	14.08	586,337
	1996- 19.06	11.09	643,448
HRSD-York STP	1985- 7.36	21.51	481,922
	1996- 10.98	19.08	637,734
West Point STP	1985- .50	18.70	28,462
	1996- .68	18.70	38,709

Facility	Avg. Flow (MGD)	TP Conc (MG/L)	TP Discharged (LBS/YR)
BP-Amoco Yorktown	1985- 1.43	.51	2,220
	1996- 64.68	.15	29,534
~~St. Laurent Paper~~	~~1985- 13.68~~	~~5.80~~	~~241,531~~
	1996- 19.06	1.40	81,229
HRSD-York STP	1985- 7.36	6.79	152,127
	1996- 10.98	1.42	47,462
West Point STP	1985- .50	6.40	9,741
	1996- .68	2.50	5,175

This region contains the following HUP subwatersheds: F13 and F14, and F21 through F27. There are still dominant agricultural and forestal land uses in the lower York region; however, urbanization is rapidly encroaching from the Hampton Roads area. This is reflected in the subwatersheds F26 and F27 have a high potential for pollution from urban land use; and F27 is classified by DCR as a top 100 priority watershed for overall nonpoint source pollution. DEQ has listed one stream segment as being impaired by fecal coliform and that is the Pamunkey River from Route 654 to Macon Creek. The source of this pollution is unknown at this time but may be related to agriculture or some other nonpoint source pollution source.

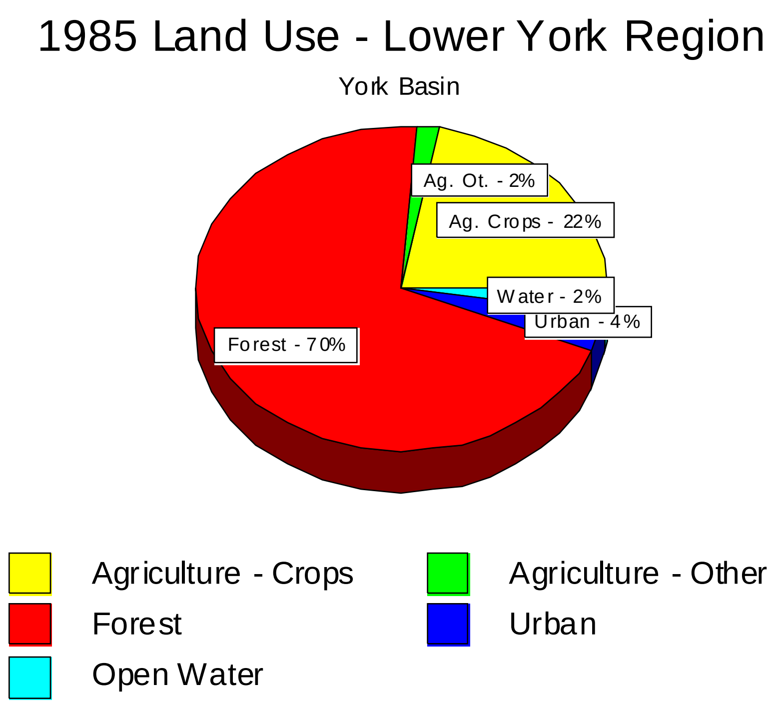
Nitrogen. In the base year of 1985, agricultural crops were the largest contributor of controllable nitrogen loads at 50% in the lower York. Point sources were a close second in the lower York at 35%. Other agriculture (animal waste acres and pasture) accounted for another 4% of the nitrogen load. Urban runoff loads amounted to 7%, while septic nitrogen loads accounted for 4%. With the increases in urbanization between 1985 and 1996, nitrogen loadings increased from urban sources to 8% from runoff, 5% from septic, and 39% from point sources.

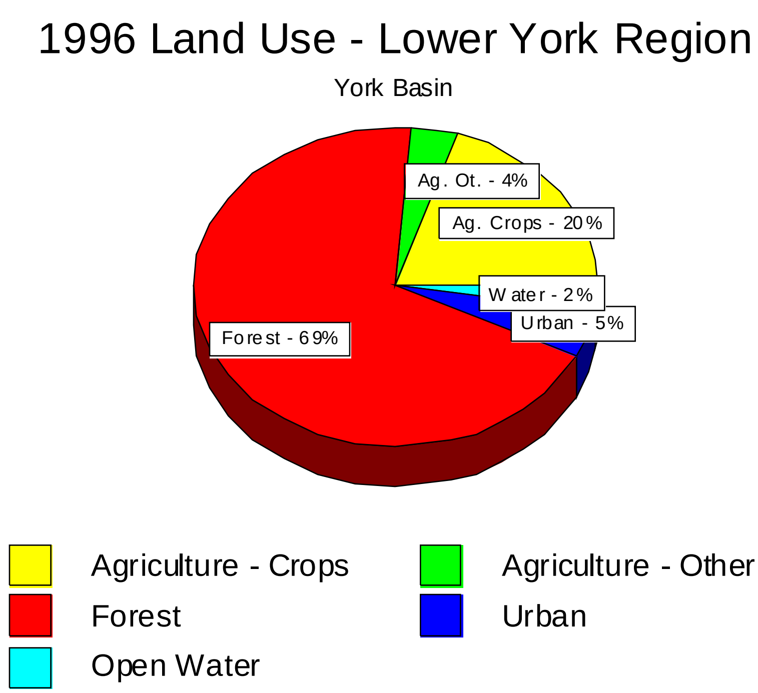
Land use breakdowns in the lower York are also similar to the watershed as a whole. This is true for both the base year of 1985 and progress year of 1996. Forest is the dominant use at 70% in 1985 and 69% in 1996. The next largest use is agricultural crops at 22% for 1985 and 20% for 1996 and other agriculture at 2% for 1985 and 4% for 1996. Urban land is a relatively small use in this part of the watershed at 4% in 1985 and 5% in 1996. In comparing the land uses of the two years, urban land and other agriculture increased, while forest land and agricultural crops decreased.

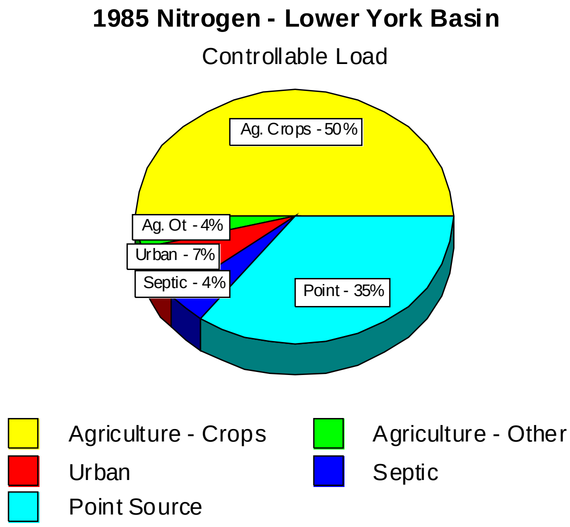
Loadings are derived from these land uses. For the purposes of this discussion, only controllable loads are discussed.

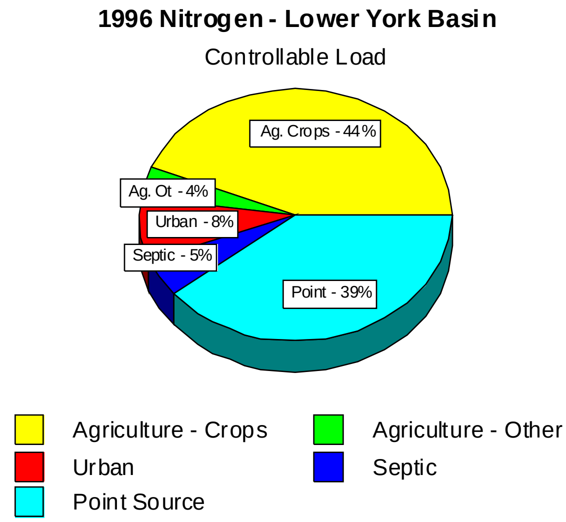
Agricultural loads declined but remained the dominant source of nitrogen in the region. These decreases in the controllable agricultural loads are probably due to the increase in urbanization.

Phosphorous: In the base year of 1985, point sources were the largest contributor of controllable phosphorus loads at 74% in the lower York. Agricultural crops accounted for 22% and other agriculture (animal waste acres and pasture) another 1% of the phosphorous load. Urban runoff loads amounted to 3%. Between 1985 and 1996, phosphorous loadings increased from urban sources to 7% from runoff. Point source loads decreased to 55% due to the Phosphate detergent ban and operational improvements at STPs. In the lower York region, controllable phosphorous from agricultural crops increased to 37% of the load.


1985 Land Use - Lower York Region
York Basin
Ag. Ot. - 2%
Ag. Crops - 22%
Water - 2%
Urban - 4%
Forest - 70%
Agriculture - Crops
Agriculture - Other
Forest
Urban
Open Water


1996 Land Use - Lower York Region
York Basin
Ag. Ot. - 4%
Ag. Crops - 20%
Water - 2%
Urban - 5%
Forest - 69%
Agriculture - Crops
Agriculture - Other
Forest
Urban
Open Water





Changes from 1985 - 1996 Nitrogen Loads by Source

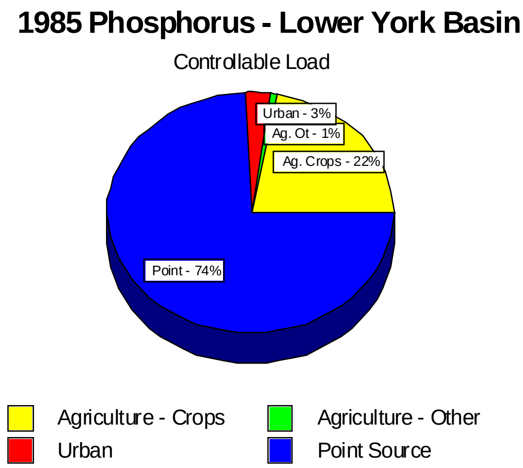
Lower York - York Basin

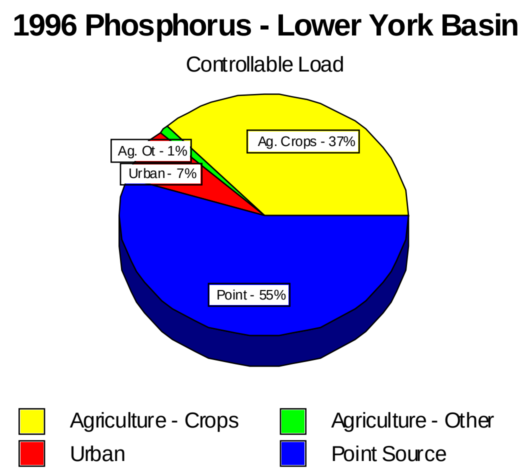
Controllable Loads

	1985	1996	Change
Agriculture - Crops	1,793,956 lbs.	1,653,731 lbs.	-140,225 lbs. -8%
Agriculture - Other	134,607 lbs.	157,557 lbs.	+22,950 lbs. +17%
Urban	251,606 lbs.	292,405 lbs.	+40,799 lbs. +16%
Septic	125,188 lbs.	168,099 lbs.	+42,911 lbs. +34%
Point Source	1,254,477 lbs.	1,437,914 lbs.	+183,437 lbs. +15%
TOTAL	**3,559,834 lbs**	**3,709,707 lbs.**	**+149,873 lbs. +4%**

Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.
Agriculture - other includes pasture and animal waste generators.

These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.





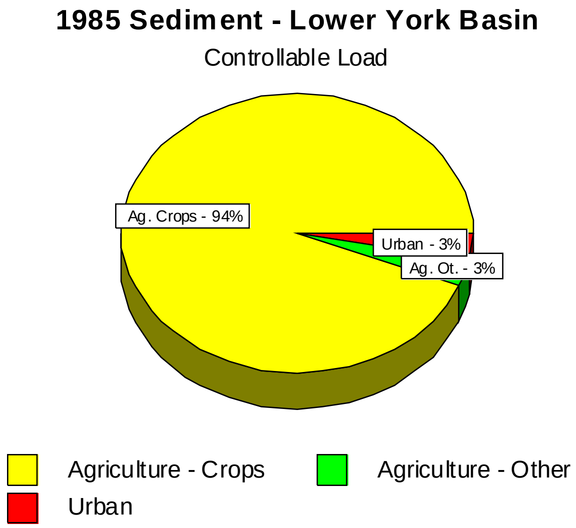
Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.
Agriculture - other includes pasture and animal waste generators.
These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

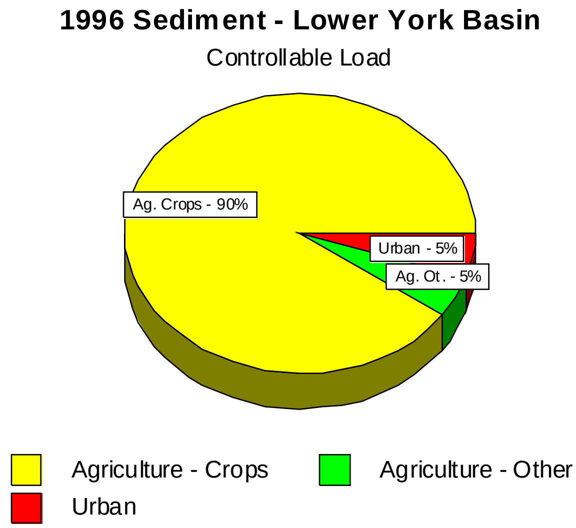
Changes from 1985 - 1996 Phosphorus Loads by Source

Lower York Region - York Basin
Controllable Loads

	1985	1996	Change	
Agriculture - Crops	122,357 lbs.	109,628 lbs.	-21,729 lbs.	-10%
Agriculture - Other	4,964 lbs.	3,470 lbs.	-1,494 lbs.	-30%
Urban	18,374 lbs.	21,353 lbs.	+2,979 lbs.	+16%
Point Source	405,619 lbs.	163,844 lbs.	-241,775 lbs.	-60%
TOTAL	**551,314 lbs.**	**298,295 lbs.**	**-253,019 lbs.**	**-46%**

Sediment. In the base year of 1985, agricultural crops were the largest contributor of controllable sediment loads at 94% in the lower York. Other agriculture (animal waste acres and pasture) accounted for another 3% of the sediment load. Urban runoff loads amounted to 3%. By 1996, the percentage of the controllable sediment load for crops decreased to 90%, increased to 5% for other agriculture and urban.





Changes from 1985 - 1996 Sediment Loads by Source

Lower York Region - York River Basin

Controllable Loads in tons

	1985	1996	Change	
Agriculture - Crops	26,338 tons	22,064 tons	- 4,274 tons	- 16%
Agriculture - Other	684 tons	1098 tons	+ 414 tons	+ 61%
Urban	954 tons	1110 tons	+ 156 tons	+16%
TOTAL	**27,976 tons**	**24,272 tons**	**- 3,704 tons**	**- 13%**

Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.
Agriculture - other includes only pasture because animal waste does not contribute sediment loading.

These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

Lower York Coastal Basins: Mobjack Bay and Piankatank River

For the purposes of this analysis, the Lower York Coastal Basin region includes the following localities: part of Essex County (16,300 acres), part of Gloucester County (94,400 acres), part of King and Queen County (46,000 acres), part of Mathews County (58,000 acres), and part of Middlesex County (36,000 acres). The regional watershed also includes parts of the Three Rivers and Tidewater Soil and Water Conservation Districts.

The only point source in the western coastal basins is the Mathews Courthouse STP.

This region contains the following HUP subwatersheds: Mobjack Bay includes C04,C05, and C06; and the Piankatank includes C02 and C03. Subwatersheds C03 through C06 are considered high potential for pollution from urban land uses. Subwatersheds C03 and C06 are also considered among the top 100 watersheds for overall nonpoint source pollution potential.

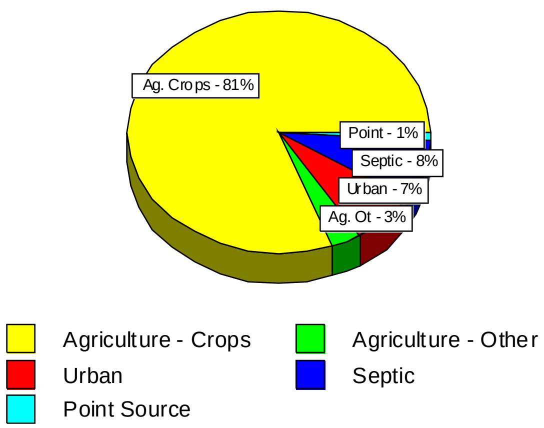
Land use breakdowns in the western coastal basins are not yet disaggregated between Mobjack Bay and the Piankatank, but overall they are similar to the watershed as a whole. This is true for both the base year of 1985 and progress year of 1996. Forest is the dominant use at 74% in 1985 and 73% in 1996. The next largest use is agricultural crops at 17% for both 1985 and 1996. Other agriculture is at 1% for 1985 and 1996. Urban land is a relatively small use in this part of the watershed at 4% in 1985 and 5% in 1996. In comparing the land uses of the two years, urban land increased while forest land decreased. Other uses remained constant.

Loadings are derived from these land uses. For the purposes of this discussion, only controllable loads are discussed.

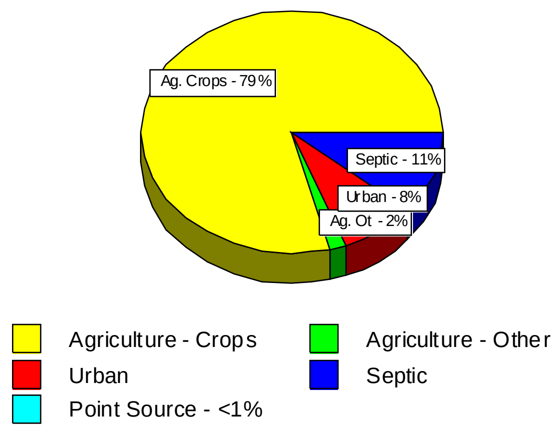
Nitrogen. In the base year of 1985, agricultural crops were the largest contributor of controllable nitrogen loads at 81% in the coastal basins. Other agriculture (animal waste acres and pasture) accounted for another 3% of the nitrogen load. Urban runoff loads amounted to 7%, while septic nitrogen loads accounted for 8%, and point sources at 1%. With the increases in urbanization between 1985 and 1996, nitrogen loadings increased from urban sources to 8% from runoff and 11% from septic. Agriculture loads declined but remained the dominant source of nitrogen in the region at 79%. These decreases in the controllable agricultural loads are probably due to the increase in urbanization.

These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

1985 Nitrogen - Lower York Coastal Basins
Controllable Load



1996 Nitrogen - Lower York Coastal Basins
Controllable Load



Changes from 1985 - 1996 Nitrogen Loads by Source

Lower York - Coastal Basins

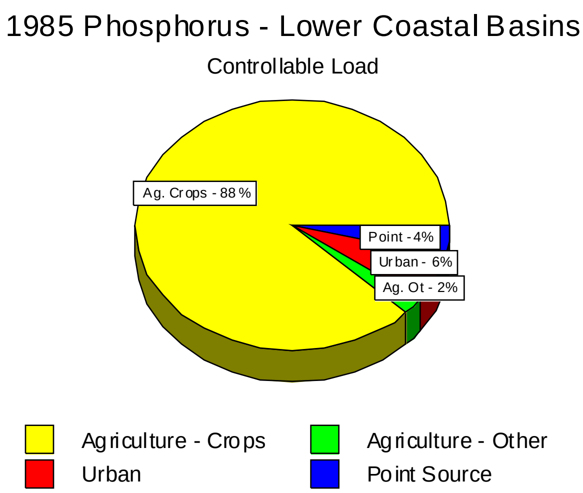
Controllable Loads

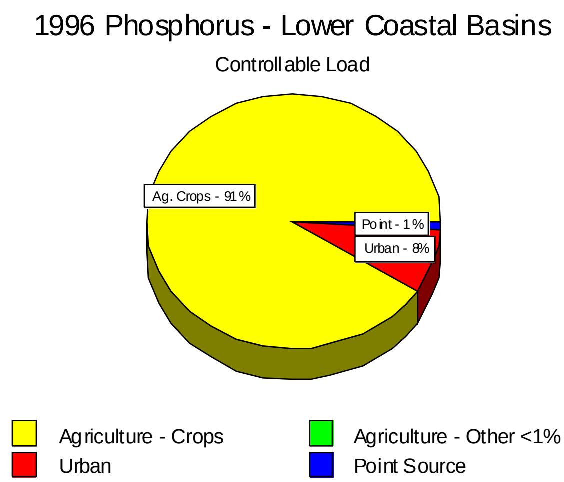
	1985	1996	Change
Agriculture - Crops	779,883 lbs.	750,596 lbs.	-29,285 lbs. -4%
Agriculture - Other	29,835 lbs.	15,931 lbs.	-13,898 lbs. -47%
Urban	67,589 lbs.	79,557 lbs.	+11,968 lbs. +18%
Septic	79,880 lbs.	106,000 lbs.	+26,120 lbs. +33%
Point Source	8,539 lbs.	1,468 lbs.	-7,071 lbs. -83%
TOTAL	**965,726 lbs**	**953,552 lbs.**	**-12,174 lbs. -1%**

Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.
Agriculture - other includes pasture and animal waste generators.

These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

Phosphorous. In the base year of 1985, agricultural crops were the largest contributor of controllable phosphorus loads at 88% in the coastal basins. Point sources accounted for 4% and other agriculture (animal waste acres and pasture) another 2% of the phosphorous load. Urban runoff loads amounted to 6%. Between 1985 and 1996, phosphorous loadings increased from urban sources to 8% from runoff and from agricultural crops to 91%. Point source loads decreased to 1% due to the Phosphate detergent ban and operational improvements at treatment plants.





Changes from 1985 - 1996 Phosphorus Loads by Source

Lower York Region - Coastal Basins

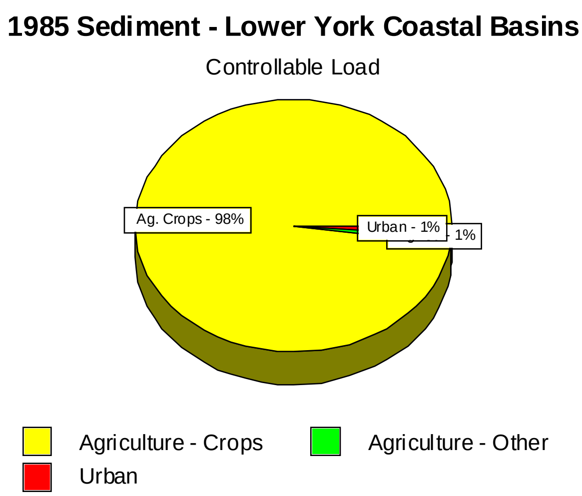
Controllable Loads

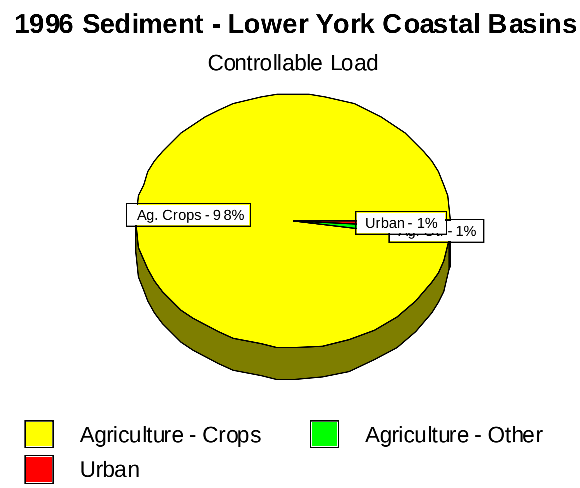
	1985	1996	Change	
Agriculture - Crops	60,075 lbs.	58,107 lbs.	-1,968 lbs.	-3%
Agriculture - Other	1,295 lbs.	229 lbs.	-1,066 lbs.	-82%
Urban	4,202 lbs.	4,946 lbs.	+ 744 lbs.	+18%
Point Source	2,922 lbs.	389 lbs.	-2,533 lbs.	-87%
TOTAL	**68,494 lbs.**	**63,671 lbs.**	**-4,823 lbs.**	**-7%**

Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.
Agriculture - other includes pasture and animal waste generators.

These numbers were provided by the Department of Conservation and Recreation and are based on the watershed model of the Chesapeake Bay Program.

Sediment. In the base year of 1985, agricultural crops were the largest contributor of controllable sediment loads at 98% in the coastal basins. Other agriculture (animal waste acres and pasture) accounted for another 1% of the sediment load. Urban runoff loads amounted to 1%. By 1996, the percentage of the controllable sediment load for crops decreased to 97%, increased to 2% for other agriculture and stayed at 1% for urban.





Changes from 1985 - 1996 Sediment Loads by Source

Lower York Region - Coastal Basin

Controllable Loads in tons

	1985	1996	Change	
Agriculture - Crops	24,498 tons	22,135 tons	- 2,363 tons	- 10%
Agriculture - Other	361 tons	360 tons	- 1 tons	-<1%
Urban	179 tons	210 tons	+ 31 tons	+17%
TOTAL	**25,038 tons**	**22,705 tons**	**- 2,333 tons**	**- 9%**

Notes: Agriculture - crops includes conservation tillage and conventional tillage as well as hayland.
Agriculture - other includes only pasture because animal waste does not contribute sediment loading.

York River Water Quality and Living Resource Status and Trends

During March of 1998, fifty of the top scientists in the Mid-Atlantic region who study water quality and living resources were convened at the Virginia Institute of Marine Science to bring together their combined research and knowledge of the status and trends of the Rappahannock, York and James Rivers. These scientists determined that the York River recently suffered degradations caused by increased loadings of nutrients and sediments, exacerbated by recent high-flow rainfall years. Much of the information presented in this section are excerpts of information collected, researched, and discussed at that meeting.

Water quality and living resource monitoring results are expressed as a comparison between Chesapeake Bay tributaries. The status of such parameters as water clarity, plankton, zooplankton, benthic, and submerged aquatic vegetation are expressed as good, fair, or poor as compared to other Bay areas. This comparison does not necessarily mean that a tributary meets all of the requirements for living resource restoration. Rather, it provides a relative comparison with similar ecosystems in the Bay watershed.

In the following discussion of water quality, the terms good, fair, and poor are often used to describe current status. These are statistically based classifications developed for making comparisons to other areas within the Chesapeake Bay system. Many scientific studies have shown that the current Chesapeake Bay system has excessive and detrimental levels of nutrient and sediment pollution. Thus, these terms of good, fair, and poor are not an absolute evaluation of status but rather a statement relative to other areas of a generally degraded system. If these status evaluations compared current nutrient and sediment pollution levels of the York to those found in the York 100 years ago, or to current status of other less impacted estuaries, most statements regarding status would likely use the term poor.

Water Quality Monitoring Overview

The Department of Environmental Quality (DEQ) participates as a key member in the Federal-Interstate Chesapeake Bay Monitoring Program. This monitoring program is an important component of the scientific basis to demonstrate that Bay restoration efforts are having a positive impact.

The major component of this monitoring focuses on water quality. This component monitors key abiotic qualities of the water such as nutrient concentrations, water clarity, salinity levels, dissolved oxygen concentrations and pH. The Chesapeake Bay Monitoring program samples these parameters monthly at 63 locations throughout the Bay mainstem and tidal tributaries (i.e. tidal portions of the James, Rappahannock, York, and Elizabeth Rivers). In the York basin, there are 63 DEQ monitoring stations throughout the tidal and non-tidal portions. These stations are monitored on a monthly to quarterly frequency.

Another component of the DEQ Bay monitoring is the River Input or Fall Line component. This component measures the amounts of nutrients and sediments entering the tidal Bay tributaries from it's watershed. Intensive water quality sampling for this program is done at one site each in the James, Rappahannock, Mattaponi, Pamunkey, and Appomattox Rivers. This monitoring component will be of major importance in determining the Commonwealth's progress toward the goal of 40% reduction of nutrient inputs to the Chesapeake by the year 2000.

The DEQ also provides guidance to, and receives monitoring data from, the Alliance for the Chesapeake Bay (ACB). Volunteers for the ACB have been monitoring water quality since 1985. This program is administered under the guidance of the Monitoring subcommittee to the Implementation Committee for the interstate

Chesapeake Bay Program. In Virginia, stations have been established on the James, York, Rappahannock, Piankatank, Potomac, and Elizabeth Rivers, as well as on the creeks and embayments of the Eastern Shore. The parameters tested are air and water temperature, Secchi disk depth, total depth, salinity, pH, DO, ammonia, precipitation, field observations of water conditions and color, weather, and general conditions of the site. At five monitoring stations, samples were taken for inorganic nutrients (nitrate, ammonia, nitrite, and ortho-phosphate) in addition to their standard parameters.

York Water Quality Monitoring: Status and Trends

A network of water quality monitoring stations in the York basin provide data for characterizing water quality conditions, detecting long-term trends, understanding ecological relationships and supporting computer modeling. York River water quality is monitored by both DEQ and the Chesapeake Bay Program in several ways, and these are distinguished by the parameters that are measured. Biological monitoring generally refers to sampling of organisms such as bottom-dwelling (benthic) invertebrates, fishes, or algae, that inhabit the waterbody. This approach is most appropriate for detecting aquatic life impairments and assessing their severity.

Ambient monitoring refers to the measurement of physical or chemical parameters, such as dissolved oxygen, pH, temperature, heavy metals, nutrients, etc. This type of monitoring can be useful not only in assessing the health of a waterbody, but can help identify specific stress agents causing an impact and identify sources of this agent. Parameters measured in the York basin which are specifically related to tributary strategy development include: dissolved oxygen, total Kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, total phosphorus and orthophosphorus, suspended solids, turbidity, Fecal Coliform and Chlorophyll *"a"*.

A combination of assessment methods is the most effective approach to a successful monitoring program. Biological and ambient water quality monitoring in the York basin is performed by Virginia's Department of Environmental Quality (DEQ), U.S. Geological Survey (USGS), Old Dominion University, Virginia Institute of Marine Science, and various citizen groups. All of these data are compiled and presented by DEQ in the 303(d) Total Maximum Daily Load Priority Lists (TMDL) and the 305(b) Water Quality Assessments.

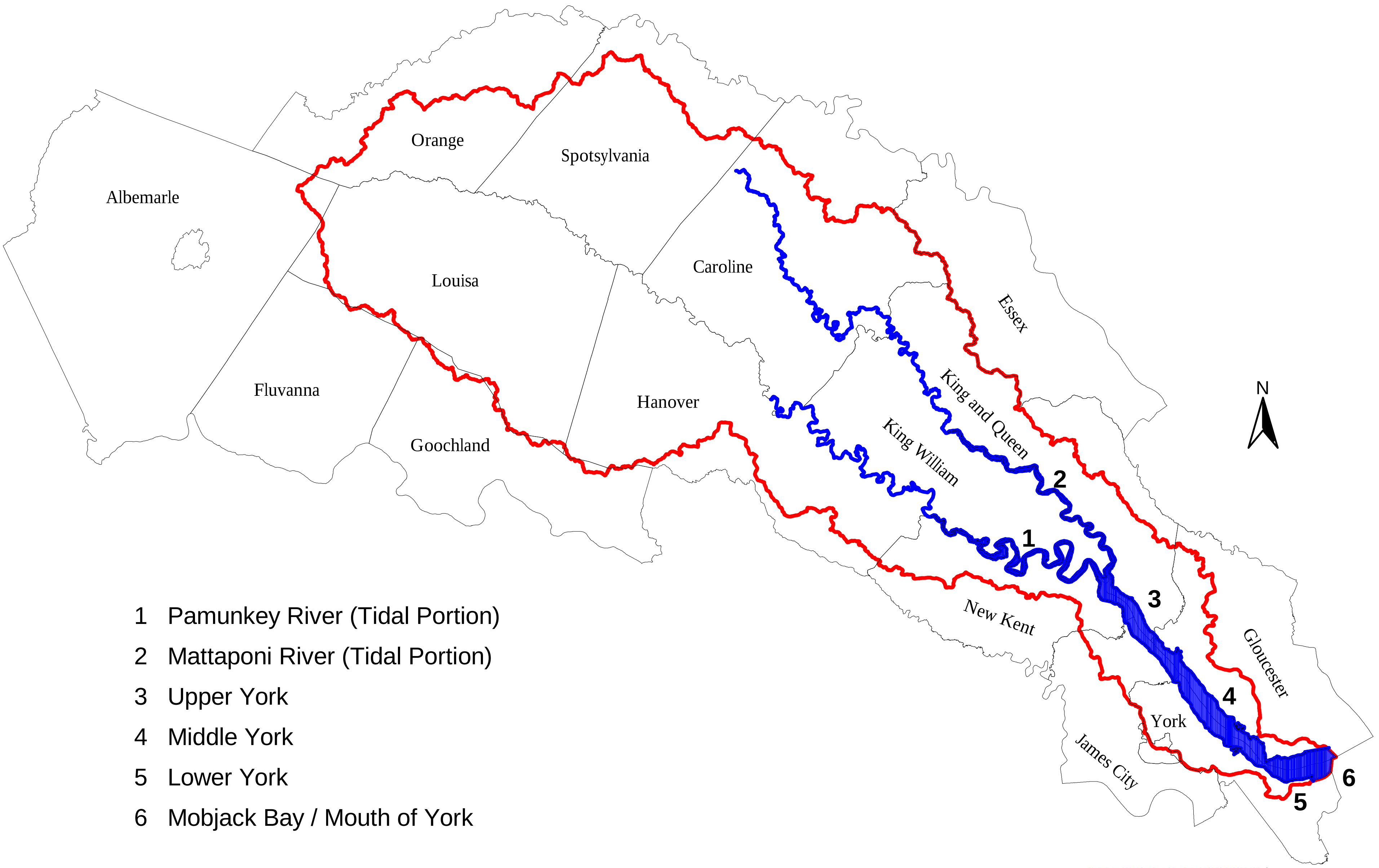
***Above the Fall Line: Nontidal*.**

The water quality in the nontidal portions of the York watershed is nonpoint source dominated. The nutrients crossing the fall line are derived from both agriculture and development. Most of the load in the nontidal portion of the watershed is not connected with wastewater treatment plants. There really have been no major changes in nutrient loads from nonpoint sources in the nontidal portion of the watershed over the period of record. Point source loads however, have increased.

Estimates of above fall line nonpoint source total nitrogen loads increased 5 percent in the York River from 2.3 million in 1985 to 2.4 million lb/yr in 1996. Estimates of above fall line nonpoint source total phosphorus loadings decreased 8 percent in the York River from 197,000 to 182,000 lb/yr from 1985 to 1996.

Point source flows increased from 1.7 MGD to 5.73 MGD above the fall line between 1985 and 1996, an increase of 237%. Point source loads of total nitrogen above the fall-line steadily increased from 82,871 lb/yr in 1985 to 326,178 lb/yr in 1996. Point source loadings of total phosphorus above the fall-line increased from 25,571 lb/yr to 39,771 lb/yr from 1985 to 1996. Nitrogen loads increased during the 1985-1996 period approximately 293%. Phosphorus loadings decreased from 1989 to 1993 as a result of the phosphate detergent ban and plant operational improvements, but rose again after that. Phosphorous loads increased during the

York River Watershed



1 Pamunkey River (Tidal Portion)
2 Mattaponi River (Tidal Portion)
3 Upper York
4 Middle York
5 Lower York
6 Mobjack Bay / Mouth of York

VIRGINIA ECONOMIC DEVELOPMENT PARTNERSHIP

September 1999

1985-1996 period approximately 55%.

Below the Fall Line: Tidal Fresh and Tidal.

The absence of strong trends in nutrient and sediment loads complicates the interpretation of water quality data and living resource responses. Results of the status and trend analysis should be interpreted with caution. Although some improvements were indicated and the status of most parameters were good, the observed patterns do not necessarily reflect the results of management actions. In addition, some parameters exhibited trends indicative of degrading conditions.

Nitrogen . Status of total nitrogen and dissolved inorganic nitrogen was good in all regions of the York River, and in those regions with an established SAV habitat requirement, dissolved inorganic nitrogen concentrations were at levels which met the habitat requirement. Improving trends in total nitrogen occurred in the upper Pamunkey and Mattaponi Rivers and lower York River. Paradoxically, total nitrogen point source loadings above the fall-line steadily increased from 1985 to 1995, while concentrations of total nitrogen in both the upper Pamunkey and Mattaponi Rivers showed a steady decline since 1985. Plots of concentrations of total nitrogen in the lower York River indicate a slight but steady increase from 1985 through 1993, followed by a decrease in concentration over the last three years. The drop in total nitrogen concentrations could reflect the drop in point source loads seen below the fall-line and/or the reduction in nonpoint source loadings. No trends were detected in dissolved inorganic nitrogen below the fall-line and plots of the concentrations of dissolved inorganic nitrogen show no apparent change over 12 years throughout the tidal York River. Additional point and nonpoint source controls of nitrogen should result in reductions of ambient concentrations.

Phosphorus . Status of total phosphorus and dissolved inorganic phosphorus was fair to good in all regions and the SAV habitat requirements for inorganic phosphorus were met only in the lower York River. Degrading trends were detected in total phosphorus and dissolved inorganic phosphorus in the upper Mattaponi and upper Pamunkey Rivers and the lower Mattaponi River. Despite reductions in both point and nonpoint source loadings of phosphorus, ambient concentrations of both total and dissolved inorganic phosphorus either increased or remained stable. Additional improvements in total phosphorus controls may be required to produce a discernable change in these two parameters.

Algae . Chlorophyll is an indicator of algal levels. Although there was only a single season- specific improving trend in algal levels over the past 12 years, the status for this parameter was good and the SAV habitat requirement was met in all regions of the York River. However, the patterns in algal levels may be the result of the poor water clarity and not the result of any management actions.

Water Clarity . Status of water clarity was poor, except in the upper Pamunkey and upper Mattaponi Rivers, where it was fair. The lack of improving trends in water clarity should be of concern since the SAV habitat requirement for this parameter was either not met or only marginally met in most regions of the York River. Water clarity for all regions were typically less than one meter in most regions of the York River during the SAV growing season.

Suspended Solids . Improvements in total suspended solids were limited to a single season-specific decreasing trend in March in the middle York River. This improvement appears to have been caused by an increase in freshwater input from the fall-line. Total suspended solids concentrations were generally marginally met in the upper Mattaponi and upper Pamunkey Rivers and the Lower York River. The SAV habitat requirement was met in the remainder of the York River. In addition, although no statistically significant trend was detected, peaks in total suspended solids concentrations in the lower York River appear to be steadily increasing.

There are preliminary lines of evidence which indicate the middle tidal reach of the York river is an effective sediment trap, with sediments potentially delivered to this area by upstream discharge, downstream by tidal and gravitational circulation, and local bank erosion.

Dissolved Oxygen . Status for dissolved oxygen was generally good in all regions of the York River except the lowest portion of the River near the mouth. The lack of significant increasing trends in summer dissolved oxygen concentrations in the York River is probably of little ecological consequence at most segments since summer concentrations in these areas have rarely dropped below 4.0 mg/L. The only exception was the lower York River where concentrations of bottom dissolved oxygen typically dropped to or below the Virginia state short-term standard (4 mg/L) during at least one summer month. Low concentrations ofdissolved oxygen constitute a management concern since they will adversely affect living resources in this region of the York River.

York Living Resources: Status and Trends

The DEQ Bay monitoring program focuses on the status of ecologically important noncommercial biological communities. The DEQ monitors these communities as a sub-set of the water quality stations so that analysts can study and understand the linkages between water quality and biological communities. Benthic communities (i.e. bottom dwelling invertebrate organisms) are monitored semi-annually at 21 fixed locations and once each summer at 100 randomly allocated stations. Planktonic communities (i.e. small plants and animals in the water) are monitored monthly at 14 stations and more intensively in fish spawning areas.

The Virginia Marine Resources Commission (VMRC) conducts two programs involved in the collection of fisheries information in the Bay. The Commercial Fisheries Harvest Reporting Program assembles data on commercially valuable species harvested from Virginia waters and nearby oceanic waters. Harvest or landings of over 50 species taken by dozens of fishing methods are analyzed on a monthly basis. This data is used to develop conservation and management strategies and to determine the benefits and impacts of proposed measures.

VMRC's Stock Assessment Program collects information concerning the biological attributes of various fish populations. This data is, in turn, used in population models to assess the health of the resource and the impacts of various levels of fishing. However, additional data on finfish populations is needed.

Effective fisheries management is currently dependent upon reliable and timely measures of the levels of harvest and the ability to detect significant changes in the fish populations. VMRC's Harvest Reporting Program and Stock Assessment Program assists in this management. Information from the program is used as a basis for fishery management decisions at the state, interstate, and federal levels. The quality of the data ensure that decisions affecting Virginia's fishermen will be based upon good science.

In general, it appears that for much of the York system living resources may be alternately limited by nutrient loads and total suspended solids. This hypothesis is developed from the fairly explicit evidence available for SAV, and the absence of a predictable response of the plankton community to nutrient and TSS loads. Scientists believe that seasonal patterns and unpredictable meteorological events will shift the dominance of nutrients and TSS, but the nature of the interactions is not presently clear.

The Chesapeake Bay Agreement states that the productivity, diversity and abundance of living resources are the best ultimate measures of the Chesapeake Bay's condition. These living resources are the ultimate focus of the restoration and protection efforts. Another point to consider in trying to evaluate the status of living resources is that restoration of degraded communities often takes better water quality than what would be required to maintain resources. In other words,
water quality may be sufficient in some areas of the York River to
maintain existing resources, but could be insufficient to restore already impaired living resources.

The following subheadings summarize the most recent information on the status of Virginia shellfish, finfish, and other living resources.

Benthos. Benthic communities are the bottom dwelling organisms living in or on the sediments at the bottom of the Bay. They are a food source for many fish and waterfowl species and are sensitive overall indicators of the Bay's health. Their populations can be affected by both toxic contaminants and low dissolved oxygen levels.

The random station sampling approach in the York River characterized only 26 percent of the bottom as having a good rating, the worst benthic community condition in the Chesapeake Bay. Low bottom dissolved oxygen does not seem to be a contributing factor in explaining the poor status of the York River benthos. There was a strong decreasing trend (47 percent decline) in the benthic community health in the middle York River. Both community biomass and species richness declined (66 percent and 54 percent, respectively) in the middle York River, and abundance declined over 99 percent in the lower York River.

The benthic community appears to be impacted primarily by water quality conditions in the lower tidal reaches; while DO conditions are not severe on an average basis, temporal variability in the system is sufficient to impact community structure. The community in the mid-tidal reach is influenced significantly by the high level of physical mixing which occurs in the benthic sediments. The upper tidal reaches are not well studied. Scientists suggest that both water quality and physical processes are locally important in this area given the morphology of the system.

Phytoplankton. Phytoplankton communities are microscopic plant organisms that form the base of the Bay's food web. In the York River, there were improving trends in the algal growth rate. Algal growth rates in the Upper Pamunkey River were limited by light in the winter-spring time period and nitrogen in the summer, the period of greatest phytoplankton abundance at this station. In the Middle York River, the magnitude and period of summer nitrogen limitation was increased. In the Lower York River there was no light limitation, but phosphorus limitation was apparent in the spring, while the summer remained nitrogen limited.

An improving trend in phytoplankton community health was detected in the middle York River. The status of phytoplankton community health, and algal growth rates were good throughout the river. There were increasing bloom producers in the tidal freshwater region, where total phosphorus increased and total nitrogen decreased. Downstream reaches of the tidal river had recurring summer and early fall blooms of dinoflagellates, some of which extended into the Virginia Chesapeake Bay. This data indicates mixed spatial and seasonal responses among the phytoplankton to conditions in the York River.

Although the general trends and several indices are favorable, the continuation of improved phytoplankton levels will depend on nutrient control practices being maintained. These actions will influence the composition and abundance of these algae throughout the river. Taken as a whole, trends in the system are mixed. Absent clear correlations with water quality parameters, scientists hypothesize that in the upper tidal reach TSS and nutrients alternate, perhaps seasonally, as the predominate controlling factor. In the middle tidal reach, scientists demonstrated that light limitation is the predominant controlling factor, although the system may be nitrogen limited in the summer. In the lower tidal reach, nutrients appear to be the predominant controlling factor, with seasonal shifts between phosphorus and nitrogen limitation, monitoring shows that there may be a greater number and duration of potentially toxic dinoflagellate blooms in the lower tidal reaches than might be present under better water quality conditions (This is based on aquaculture at Gloucester Point. However,the period of record does not extend back far enough to document a trend).

Zooplankton. Zooplankton communities are microscopic animals that serve as the primary consumers of phytoplankton. Zooplankton not only eat phytoplankton, they are also a major source of food for many fish species such as menhaden and juvenile striped bass. Therefore, scientists often look for increased zooplankton diversity as a good indicator of food availablilty for fish larvae. While there were no significant trends in species diversity in the upper Pamunkey River, zooplankton diversity showed an improving trend in the middle York River and a degrading trend in the lower York River. Status of the zooplankton community health was fair to good, while status of food availability for fish larvae ranged from poor to below minimum. The lack of trends in the upper Pamunkey River, improving trends in the middle York and deteriorating trends in the lower York River suggests an overall mixed environmental situation in the York River.

Submerged Aquatic Vegetation (SAV). Underwater grasses, known as Submerged Aquatic Vegetation (SAV), are recognized as a key biological indicator of the Bay's health. Populations of SAV have been intensively monitored since 1978. They have increased throughout the Bay by 72% since 1984 but are still well below levels known to have been present as recently as the early 1960's. Their complete recovery continues to be inhibited by poor water quality conditions in many areas.

Evidence from 1930s and 1950s aerial photography has documented historical distributions of SAV in the York River system, principally eelgrass. Eelgrass has a distinctive visual pattern or signature that is well-known from recent aerial photos that were ground-truthed to verify that it was eelgrass. SAV was located along the river banks and up in the small creeks along the lower York River from the river mouth up through Claybank, Virginia. The north shore showed SAV distributions farther upriver than the south shore. The reason for the north vs. south shores SAV distribution differences could be due to circulation patterns and turbidity plumes, shadows, and possibly higher organic enrichment of the bottom sediment along the south shore.

Within the middle York River (north of Claybank to West Point where the Pamunkey and Mattaponi join to form the York), SAV has been documented since 1978 through ground surveys in tidal creeks and tributaries to the mainstem York. Along the Pamunkey and Mattaponi, there is documentation of SAV presence through ground surveys.

Aerial survey data showed that SAV area continued to increase slightly in the lower York River in 1995 and 1996, but none has been mapped in the middle and upper segments of the river since the first SAV aerial surveys were done starting in 1971. The 1996 SAV area in the lower York identified 211 acres and was the highest mapped acreage since the 605 acres mapped in 1971, the first year surveys were done. Most of the SAV in the lower York is located along the north shore from Gloucester Point downriver to the boundary with the

Mobjack Bay segment, and in smaller beds on the south shore in the same region, from just above Yorktown, downriver to the mouth of Wormley Creek.

As noted above, only the lower York River had mapped SAV in the York River. The lower York River had fairly good water quality for SAV growth, with all five habitat requirements met or borderline in all years with data. All of the SAV habitat requirements were borderline more often than they were met, except chlorophyll "*a*" which was met more often than it was borderline. Water quality in middle York River was poorer for SAV growth, with three of the five SAV habitat requirements not being met in all years (light attenuation coefficient, total suspended solids, and dissolved inorganic phosphorus); only the chlorophyll "*a*" requirement was met in most years. Farther up in oligohaline portion of the York River, the SAV habitat requirements for light attenuation coefficient, and total suspended solids were not met in all years except when they were borderline. In two years chlorophyll "*a*" and dissolved inorganic phosphorus were exceeded or borderline. Water quality was better in the tidal fresh segments in the Mattaponi and Pamunkey, with all SAV habitat requirements being met or borderline. Exceptions were dissolved inorganic phosphorus, light attenuation coefficient, and total suspended solids which were not met a few years each. No SAV has been mapped in the Mattaponi and Pamunkey Rivers through the aerial survey, but ground truthing has reported some SAV (see above). None of the trends for SAV parameters were significant in the York, but there may have been detection limit problems for dissolved inorganic nitrogen and dissolved inorganic phosphorus trends.

Currently limited to the lower tidal reach, predominately along the north shore, habitat requirements for SAV are exceeded at the lower portions of the mid-tidal reach. Scientists propose that both nutrients and TSS are significant limitations to regrowth of SAV in this reach.

Restoration of water quality in these two rivers should promote a return of SAV to the limited amount of habitat along the mainstem rivers and in the small creeks and tributaries entering into both rivers. Given that both the Mattaponi and Pamunkey Rivers are much narrower than the York River with significant fringing tidal marshes, this results in limited available shallow water habitat along the main river channels for SAV restoration between the marshes and habitats often too deep for SAV.

Emphasis should initially be placed on restoring water quality conditions suitable for SAV survival and growth in the lower third of the York River where we have the best opportunity to restore SAV. This region has been designated as post larval recruitment settlement habitat in the Chesapeake Bay Program Blue Crab Fisheries Management Plan. From there, emphasis should be placed on the middle York River and restoration of the habitat quality necessary to allow for the return of the middle and lower salinity SAV species to the middle river's shallow water habitats. There may be some limitations on the extent of SAV revegetation due to the sediment substrate composition in the middle York River, particularly along the south shore, where already elevated levels of organic enrichment are even higher.

The following table shows current tributary water quality conditions in relation to the five SAV habitat objectives based on the *Second Annual Report on the Development and Implementation of Nutrient Reduction Strategies for Virginia's Tributaries to the Chesapeake Bay, 1997*.

York River SAV Habitat Objectives

Parameter/Region	Upper Pamunkey	Lower Pamunkey	Upper Mattaponi	Lower Mattaponi	Middle York	Lower York
Available Light	Borderline	Fails	Meets	Fails	Fails	Borderline
Phytoplankton	Meets	Meets	Meets	Meets	Meets	Meets
Suspended Solids	Meets	Fails	Meets	Fails	Fails	Borderline
Phosphorus	Fails	Fails	Fails	Borderline	Fails	Meets
Nitrogen	N/A	N/A	N/A	N/A	Meets	Meets

Fisheries. Bay anchovies have declined. Bay anchovies are small fish that feed on microscopic animals that float in the water called zooplankton. The decline in Bay anchovies may suggest that the decline in food resources in the lower reaches of the river may be the local cause. Menhaden are also declining. Menhaden are small fish that feed on microscopic plants that float in the water called phytoplankton and the absence of a clear trend in phytoplankton communities for the river confounds efforts to develop an hypothesis. Scientists suggest that changes in the pattern of phytoplankton availability in the system may have an impact.

Striped Bass. Striped bass continue their recovery beyond historically high levels and now support healthy commercial and recreational fisheries. However, findings of low body weight in adult fish may indicate a lack of traditional food sources.

Migratory Fish. Spring runs of American shad, hickory shad, blueback herring, and alewife in the Bay are currently depressed. It is believed that the decline in these fish is the result of obstructions to traditional spawning areas as well as other causes.

Blue Crab. Recent levels of abundance of the Chesapeake Bay adult blue crab population have been average, in comparison to long-term (1956-present) levels, but lower than very high levels of abundance in the 1980s. At the same time, recent harvests (1994-96) have been lower than average levels over the last 20 years. Historical information indicates a long-term shift in blue crab population abundance caused by tropical Storm Agnes in 1972. Studies by the Virginia Institute of Marine Science suggest the storm caused a dramatic loss of seagrass habitat and food for the blue crab within the Chesapeake Bay. With the expansion of seagrasses since 1972, similar increases have occurred in juvenile blue crabs, but not adult crabs. Future improvements in levels of abundance and harvest can occur quickly.

Oysters. Populations of oysters, which provide great economic and ecological benefits to the Bay region, are very low. Reasons for the decline have been related to historic overfishing, habitat degradation, poor water quality, and more recently, oyster diseases.

Waterfowl. Virginia is enjoying the rebound of many Atlantic Flyway duck populations, allowing the state to expand the duck season to sixty days and to liberalize bag limits. On the other hand, the migratory Canada goose population has shown a precipitous decline largely due to over-harvest and poor reproductive success. However, biologists are confident that the implementation of sound management techniques, such as the current season closure, will restore populations as they were restored in the Mississippi Flyway in recent years. The resident goose population continues to increase in Virginia.

Status and Trends Summary

In general, the use of relative indicators for comparison of conditions among tributaries, provides the initial impression that the York will not require as much effort as the other tributaries. A more correct picture may be that the York system retains a greater potential for restoration than any of the other systems. There is a real need for both nutrient and sediment load reductions throughout the system. Indeed, for successful restoration of most of the resources considered in this exercise, both nutrients and sediments must be addressed simultaneously.

- Point source loads showed little change through 1996 however, additional point source nutrient loads are expected in the river basin during the coming decade.
- Fall-line nutrients show mixed trends.
- Improvements in algal levels in upper and middle York River (Initial values low - little ecological significance).
- Improvements in nitrogen in upper York River.
- Degrading trends in nitrogen in the lower York River and phosphorus in the upper and middle York.
- Status of water clarity is poor in the middle York River.
- Status of dissolved oxygen is good except the lower York River where it was fair.
- Among Virginia tributaries, the lowest algal levels and nutrients are in the upper and middle York River.
- Improving trends in phytoplankton and zooplankton health in the middle York River.
- Deteriorating trend in zooplankton health in lower York River.
- Deteriorating trends in benthos in the middle York River and poor status throughout.

III. ASSESSMENT OF BASIN NUTRIENT ISSUES, PROGRESS, AND CONTROL OPTIONS

The York River system is unique in that it is still a heavily forested watershed with approximately 73% of the land area draining to the basin still under forest cover. The next largest land use type is agriculture, followed by urban land uses. The river system is a nonpoint source dominated system and as such, most of the nutrient reduction efforts to be undertaken in the York will need to emphasize the management of pollution through the use of best management practices (BMPs) on agricultural and urban lands. Point source reductions are unlikely to be as significant a part of the Final York Strategy to reduce the nutrient gap as they were in the Potomac. However, the management of point source loads may have a significant role in maintaining achieved reductions in the face of expected growth.

A preliminary review of land use conversion trends in the basin seem to indicate growing pressures on agricultural and forest lands to convert to urban land uses. Significant conversions are occurring in the southern portion of the watershed as the Hampton Roads area expands into Gloucester County and along the I-95 corridor, particularly in and around Spotsylvania County and Fredericksburg. Population levels in the York River basin rose from 139,000 to 182,000 individuals from 1985 to 1996.

Overall, point source loads are a relatively small portion of the nutrient load in the York basin (as a proportion of the total load). It is important to note that this may be because the beginning of significant growth in the basin corresponds roughly to the late 1980s time frame; therefore, plants still have capacity to address current growth. While still a proportionately small percentage of the total nutrient loads, point source flows increased in the basin by as much as 310%. According to stakeholders, several new facilities are planned to come on line in the basin after the Year 2000. A new plant is expected in Hanover County, and as many as two new plants may be constructed in Spotsylvania County.

Assessment Process To Date

Stakeholder Tributary Initiatives

Given the nonpoint focus of the York Strategy, Soil and Water Conservation Districts (SWCDs) have played a vital role in the identification, evaluation, and recommendation of BMPs that are effective in reducing nutrients, practical, and cost-effective.

The SWCDs have played a very important role in facilitating the initial dialogue about the strategy development process. It is anticipated that this role will continue.

The York Watershed Council was established in 1996 to bring SWCDs,local officials, and nongovernmental organizations (NGOs) together to discuss the opportunities presented by a watershed approach for achieving a number of water quality and water quantity goals in the basin. The Council has had several annual meetings that have demonstrated a number of tools to make it possible to plan for these issues. Their initial focus involved working with the Comprehensive Coastal Inventory Program at VIMS in developing a GIS of the entire York watershed by soliciting the information from stakeholders to create an analytical tool. They worked on obtaining local information relating to land uses proposed in local comprehensive plans and local zoning designations, compiling it into a GIS to look at water issues in the entire region. Their work created an integrated mix of interested parties with the capacity to look at water quality issues from a watershed perspective. NGO participation by the Mattaponi and Pamunkey Rivers Association and the York Chapter of the Chesapeake Bay Foundation have been critical to understanding the perspective of citizen stakeholders in the basin, and in confirming our understanding of local land use conditions and existing water quality and resource issues. The Council has provided significant support to the state's efforts to date, coordinating closely with the Tributary Team on addressing water quality and water quantity issues from a watershed-based regional perspective.

The Council received a Chesapeake Bay License Plate grant, a grant from the Chesapeake Bay Local Assistance Department (CBLAD), DCR tributary strategy development money earmarked for Soil and Water Conservation Districts (SWCDs), and a Virginia Environmental Endowment grant, to develop an educational workshop for local elected officials and SWCD board members, and to develop a series of demonstration BMP projects. During the Spring of 1997, this workshop was presented by the Council's coordinator and the York Team Leader to the majority of stakeholders, including the Middle Peninsula Planning District Commission (MPPDC) Nutrient Reduction Task Force, the Hanover-Caroline SWCD Board, the Caroline County Board of Supervisors, and the Spotsylvania County Board of Supervisors.

Demonstration projects were scheduled in the lower, middle, and upper parts of the watershed. These included: 1) two riparian buffer re-establishment projects (one in conjunction with Virginia Power and the Tidewater SWCD, and a second in conjunction with Gloucester County and the Tidewater SWCD); 2) two agricultural nutrient management projects (nutrient management in King and Queen County/Hanover-Caroline SWCD and New Kent County/Colonial SWCD); and finally 3) an integrated agricultural and urban nutrient management project for Lake Anna (in conjunction with several farmers, Tri-County City and Culpeper SWCDs, the Lake Anna Citizens Association, and Virginia Power and Orange, Culpeper, and Spotsylvania Counties). Given the nonpoint source influence over water quality in the York, these projects have and will continue to serve as a focal point for discussing the kinds of BMPs that can be considered in implementing a local strategy with local elected officials. The SWCDs are actively involved in the development and delivery of the technical information needed to assist local elected officials to make policy decisions.

A field day for elected officials in the Hampton Roads area to see in-the-field installations of a number of nonpoint source BMPs was put on by the Hampton Roads Planning District Commission in partnership with the Tidewater and Colonial SWCDs and the York Watershed Council. A demonstration of the nutrient reduction potential of using biosolids as an alternative to commercial fertilizers while maintaining productivity, was conducted by the Hanover-Caroline SWCD in partnership with the York Watershed Council. Both of these events were made possible with financial assistance of CBLAD and DCR. These events were well attended and appear to have assisted in the education of stakeholders on these issues.

In conjunction with the Virginia Institute of Marine Science (VIMS), the York Watershed Council developed a series of pollution potential maps that generally rate the pollution potential of an identified subwatershed unit. These rankings are identified for agricultural, silvicultural, and urban uses. It is anticipated that this set of maps will be useful in determining the type and location of the most cost-effective approaches to reduce nutrients. Each locality and SWCD was provided a set of these maps. Financial aid was provided for this project by CBLAD and DCR.

The York Watershed Council, particularly the non-governmental organizations, have developed and are implementing a citizen monitoring program to monitor nutrients in each of the basin's twenty-seven subwatersheds on a quarterly basis. This data should be helpful in ascertaining whether the pollution potential tools used in the strategy development process relate to what is being observed in the field. This project should also assist in targeting nutrient problems cost-effectively. This project was provided financial assistance by the Department of Environmental Quality and the Virginia Environmental Endowment.

The Middle Peninsula Planning District Commission established a Nutrient Reduction Task Force to involve localities in the process of developing tributary plans, gathering and analyzing data, and providing educational opportunities to educate citizens on the issues in the region. They discussed a number of topics including, the feasibility of installing Biological Nutrient Removal (BNR) at local wastewater treatment plants, watershed targeting, land use conversion, agricultural production and their associated BMPs, and habitat relationships to nutrient levels. One particular conclusion developed by this group was that the feasibility of moving local wastewater plants to the use of Biological Nutrient Removal (BNR) would require doubling the storage capacity of the plants and significantly upgrading the expertise of local plant operators.

The Hampton Roads Planning District Commission has established a Project Steering Committee to involve localities in the Hampton Roads area in the York and James tributary Strategies. This group has continued to provide local feedback on efforts to date, have developed local data sets of existing local efforts to reduce nutrient pollution, and developing potential options for nutrient reductions. They have assigned members to the York Watershed Council and coordinate closely with the state's York Tributary Team Leader.

The Richmond Regional Planning District Commission has been involved in support activities for strategy development and have provided support for the efforts of the York Watershed Council.

The Initial York Strategy Development Process

Local government elected officials and staff were invited and many participated in a York Watershed Conference held in May 1997. The conference, sponsored by the York Watershed Council was held to familiarize stakeholders with the strategy process, the opportunities presented by using a watershed approach, and an introduction to tools under development to assist them in the strategy effort. These workshops along with the noted demonstration projects assisted stakeholders in addressing the model outputs in an informed way that was not possible in the Potomac.

At that time, Virginia was working closely with the Chesapeake Bay Program on developing an enhanced modeling capability and refining our 10-year trend analysis of water quality conditions (from monitoring) in the lower tributaries. The York Tributary Team received the modeling results back from the Chesapeake Bay Program later than expected. Delays in the completion of the model were due primarily to the complexity of the technical issues related to the model, including the addition of a refined air deposition load, the addition of a septic load, and a refinement of the land use base used to develop the nonpoint source loadings.

Local government and SWCD Board presentations were made during the Fall of 1997 by the York Tributary Team Leader and the Council Coordinator. These initial meetings tried to provide local officials with a basic understanding of the tributary strategy program, its goals, and the respective roles of the state and all other stakeholders in the process of developing the strategy. Individual presentations were made to nearly all of the SWCD Boards and localities in the York basin.

In developing an assessment of current and planned actions that impact nutrient levels in the York River system, a series of meetings were held during January, February, and March 1998.

The first series of meetings involved individual meetings with local and SWCD professional staff to review basin monitoring and modeling, to discuss nutrient loading information, to confirm known nutrient reduction programs, to identify other local reduction efforts, and to consider actions that may increase nutrients in the future. During these meetings, the participants tried to assess what the dominant potential pollution sources are, their relative location in the basin, what the existing local management strategies are, what the potential management gaps are, and finally, a list of what appropriate strategies might be to address these gaps. This approach provided important confirmation by stakeholders of existing water quality issues and local management approaches.

The second series of meetings were regional stakeholder meetings that were used to identify data collection needs, define terminology, and outline the intent to develop a series of nutrient reduction scenarios for the draft initial strategy.

The third series of meetings focused on reporting back the information provided by stakeholders after the second meetings, and developing regional nutrient reduction scenarios. In developing the scenarios, stakeholders were asked to answer several questions including: 1) What reasonable management goals could be set for a list of BMPs by a specified date in the future; 2) If each stakeholder had to choose one BMP to implement, what would the most important BMP be in that stakeholder's area; and 3) What resources are needed to achieve the scenarios outlined in #1 and #2.

The BMP goal responses to question #1 are based on a projected date of 2010. The year 2010 was chosen to reflect a comparable period of time to allocate to achieving nutrient reduction goals to that used in the other lower tributaries. These 2010 goals have been interpolated to demonstrate relative BMP target levels for 2000 and 2004. As a simple analysis of nutrient reduction efforts, the interpolation exercise provides a strategic plan for the incremental achievement of the BMP coverage targets. By assigning nutrient reductions to these BMP goals we can see the relative reduction of nutrients that would result from these efforts and the relative costs. However, it is important to note that these reduction levels have not been modified to reflect increases in the nutrient load due to increases in point source flow and land use conversion (both are anticipated to occur as population increases).

The BMP responses to question #2 subjectively reflect the relative importance of a particular source of nutrients to stakeholders representing a particular locality, point source, or district. It is assumed that these responses correspond to the stakeholder's understanding of the existing land use and nutrient source conditions in their area and their knowledge of the type of BMPs that are effective in their area to address the dominant loading source.

The answers to question #3 reflect stakeholders perception of the inherent disincentives in some programs, the need for incentives in others, and the need to address a perceived inequity in regulation or access to incentives in addressing some load sources. The responses demonstrate stakeholder (all) suggestions for facilitating nutrient reductions not just those that received unanimous support. Most stakeholders felt that this exercise had the potential to serve as an important source of information for consideration by local and state elected officials, and state and federal program managers.

In completing this assessment process for nutrients, we developed the information necessary to respond to nutrient reduction goals from an informed perspective. Having completed this exercise, we were able to move quickly to complete the final strategy once the water quality modeling became available and goals were established.

It appears likely that the development and maintenance of basin tributary strategies may need to be an ongoing process into the future as growth occurs, loads change, and resource conditions change.

Nutrient Reduction Efforts to Date as a Measure of Progress

Basin stakeholders, in conjunction with the Tributary Team Leader, worked closely to evaluate levels of BMP implementation during the period 1985 through 1996-97. One of the major tasks was to review the information about BMP installation tracked through existing state programs and to confirm and reconcile this information with BMP installations known to stakeholders but not state program managers. This exercise also included an evaluation of what standards BMPs were being implemented to as this was an important element in determining the nutrient reduction of these activities. The tables below reflect the work of these stakeholders for the entire York and Coastal Basins combined, each basin individually, and the regions (upper, central, and lower) established for analysis. More detailed information for each locality follows in the regional profiles.

Nonpoint Source BMPs for York River (York River Basin): 1996-97

Based on Implementation of Current Programs (via State Tracking Information & Adjusted by Tributary Team)

BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
		Year 1996/97 Progress		Reductions (lbs or tons per year)		
Farm Plans	acres	144,311	37.1%	109,613	23,860	9,697
Nutrient Management	acres	58,251	20.9%	168,023	10,048	0
Agricultural Land Retirement	acres	6,396	1.6%	56,168	5,833	2,132
Grazing Land Protection	acres	2,414	2.2%	4,036	102	0
Stream Protection	acres	130	----	310	15	10
Cover Crops	acres	5,199	2.6%	26,178	1,037	363
Grass Filter Strips	acres	546	----	9,247	831	236
Woodland Buffer Filter Area	acres	1	----	6	1	1
Forest Harvesting	acres	10,127	70.0%	37,811	713	1,351
Animal Waste Control Facilities	systems	7	----	7,969	527	0
Poultry Waste Control Facilities	systems	9	----	1,009	97	0
Loafing Lot Management	systems	0	----	0	0	0
Erosion & Sediment Control	acres	2,296	69.6%	125,727	5,143	1,421
Urban SWM/BMP Retrofits	acres	197	0.2%	206	7	8
Urban Nutrient Mgmt / Land Retire	acres	500	0.0%	1,626	95	5
Septic Pumping	systems	pending	----	0	0	0
Shoreline Erosion Protection	linear feet	13,444	----	16,527	10,838	412
		Total Pounds Reduced:		564,458	59,148	15,635
	Adjustment for Land Use Changes:			270,160	481	(1,465)
		Adjusted Reduction:		294,298	58,668	17,100
	Nonpoint Controllable Amount:			4,198,517	340,743	122,791
		Percent Reduction:		7.0%	17.2%	13.9%

Nonpoint Source BMPs for Mobjack Bay and Piankatank: 1996-97
(Coastal Basins)

Based on Implementation of Current Programs (via State Tracking Information & Adjusted by Tributary Team)

BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
		Year 1996/97 Progress		Reductions (lbs or tons per year)		
Farm Plans	acres	19,185	42.3%	27,768	6,646	3,063
Nutrient Management	acres	11,306	26.9%	58,623	(1,230)	0
Agricultural Land Retirement	acres	1,704	3.8%	29,204	2,341	921
Grazing Land Protection	acres	141	4.3%	445	3	0
Stream Protection	acres	0	----	0	0	0
Cover Crops	acres	1,404	3.6%	9,928	360	159
Grass Filter Strips	acres	65	----	1,919	175	72
Woodland Buffer Filter Area	acres	4	----	121	11	5
Forest Harvesting	acres	1,838	70.0%	9,329	129	386
Animal Waste Control Facilities	systems	0	----	0	0	0
Poultry Waste Control Facilities	systems	0	----	0	0	0
Loafing Lot Management	systems	0	----	0	0	0
Erosion & Sediment Control	acres	260	69.6%	15,544	512	209
Urban SWM/BMP Retrofits	acres	335	3.2%	893	60	34
Urban Nutrient Management	acres	0	0.0%	0	0	0
Septic Pumping	systems	pending	----	0	0	0
Shoreline Erosion Protection	linear feet	1,189	----	7,149	4,688	81
		Total Pounds Reduced:		160,922	13,697	4,930
	Adjustment for Land Use Changes:			(134,185)	(6,909)	(3,010)
		Adjusted Reduction:		295,107	20,606	7,941
	Nonpoint Controllable Amount:			957,187	65,572	25,038
		Percent Reduction:		30.8%	31.4%	31.7%

Nonpoint Source BMPs for York River & Coastal Basins: 1996-97

Based on Implementation of Current Programs (via State Tracking Information & Adjusted by Tributary Team)

		Year 1996/97 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	163,496	37.7%	137,381	30,507	12,760
Nutrient Management	acres	69,557	21.7%	226,646	8,818	0
Agricultural Land Retirement	acres	8,100	1.9%	85,373	8,174	3,053
Grazing Land Protection	acres	2,555	2.3%	4,481	105	0
Stream Protection	acres	130	----	310	15	10
Cover Crops	acres	6,603	2.7%	36,107	1,397	522
Grass Filter Strips	acres	610	----	11,165	1,007	308
Woodland Buffer Filter Area	acres	5	----	127	12	5
Forest Harvesting	acres	11,965	70.0%	47,139	842	1,737
Animal Waste Control Facilities	systems	7	----	7,969	527	0
Poultry Waste Control Facilities	systems	9	----	1,009	97	0
Loafing Lot Management	systems	0	----	0	0	0
Erosion & Sediment Control	acres	2,556	69.6%	141,271	5,655	1,630
Urban SWM/BMP Retrofits	acres	532	0.5%	1,099	67	41
Urban Nutrient Mgmt / Land Retire	acres	500	0.0%	1,626	95	5
Septic Pumping	systems	pending	----	0	0	0
Shoreline Erosion Protection	linear feet	14,633	----	23,676	15,527	493
		Total Pounds Reduced:		725,380	72,845	20,566
		Adjustment for Land Use Changes:		135,975	(6,428)	(4,475)
		Adjusted Reduction:		589,405	79,273	25,040
		Nonpoint Controllable Amount:		5,155,704	406,315	147,830
		Percent Reduction:		11.4%	19.5%	16.9%

Nonpoint Source BMPs for Upper York Region: 1996-97

Based on Implementation of Current Programs (via State Tracking Information & Adjusted by Tributary Team)

		Year 1996/97 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	53,228	37.2%	16,646	4,064	2,872
Nutrient Management	acres	7,916	9.9%	4,562	328	0
Agricultural Land Retirement	acres	1,375	1.0%	5,491	1,017	661
Grazing Land Protection	acres	1,732	2.7%	2,687	82	0
Stream Protection	acres	57	----	83	8	5
Cover Crops	acres	537	1.6%	2,138	111	88
Grass Filter Strips	acres	78	----	584	89	57
Woodland Buffer Filter Area	acres	1	----	6	1	1
Forest Harvesting	acres	1,977	70.0%	5,455	203	384
Animal Waste Control Facilities	systems	2	----	2,183	109	0
Poultry Waste Control Facilities	systems	7	----	531	67	0
Loafing Lot Management	systems	0	----	0	0	0
Erosion & Sediment Control	acres	909	69.6%	17,168	740	487
Urban SWM/BMP Retrofits	acres	No data	0.0%	0	0	0
Urban Nutrient Management	acres	0	0.0%	0	0	0
Septic Pumping	systems	0	----	0	0	0
Shoreline Erosion Protection	linear feet	0	----	0	0	0
		Total Pounds Reduced:		57,534	6,818	4,555
		Adjustment for Land Use Changes:		41,123	(5,899)	(4,987)
		Adjusted Reduction:		16,411	12,717	9,542
		Nonpoint Controllable Amount:		619,261	84,824	53,888
		Percent Reduction:		2.7%	15.0%	17.7%

Nonpoint Source BMPs for Central York Region: 1996-97

Based on Implementation of Current Programs (via State Tracking Information & Adjusted by Tributary Team)

		Year 1996/97 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	37,649	30.4%	30,483	9,044	4,031
Nutrient Management	acres	22,837	23.7%	39,350	2,707	0
Agricultural Land Retirement	acres	2,485	2.0%	14,068	2,148	926
Grazing Land Protection	acres	446	1.6%	833	17	0
Stream Protection	acres	64	----	192	6	5
Cover Crops	acres	2,836	3.9%	12,231	553	184
Grass Filter Strips	acres	337	----	5,477	491	124
Woodland Buffer Filter Area	acres	0	----	0	0	0
Forest Harvesting	acres	4,596	70.0%	16,689	268	601
Animal Waste Control Facilities	systems	2	----	2,174	141	0
Poultry Waste Control Facilities	systems	2	----	478	30	0
Loafing Lot Management	systems	0	----	0	0	0
Erosion & Sediment Control	acres	496	69.6%	26,137	1,015	239
Urban SWM/BMP Retrofits	acres	No data	0.0%	0	0	0
Urban Nutrient Management	acres	0	0.0%	0	0	0
Septic Pumping	systems	pending	----	0	0	0
Shoreline Erosion Protection	linear feet	0	----	0	0	0
			Total Pounds Reduced:	148,111	16,420	6,109
			Adjustment for Land Use Changes:	145,923	6,273	5,342
			Adjusted Reduction:	2,188	10,147	766
			Nonpoint Controllable Amount:	1,273,899	110,224	40,927
			Percent Reduction:	0.2%	9.2%	1.9%

Nonpoint Source BMPs for Lower York Region: 1996-97

Based on Implementation of Current Programs (via State Tracking Information & Adjusted by Tributary Team)

		Year 1996/97 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	53,434	43.9%	62,483	10,751	2,794
Nutrient Management	acres	27,498	26.7%	124,111	7,014	0
Agricultural Land Retirement	acres	2,536	2.1%	36,610	2,669	545
Grazing Land Protection	acres	235	1.3%	516	3	0
Stream Protection	acres	9	-----	35	0	0
Cover Crops	acres	1,827	1.9%	11,809	374	90
Grass Filter Strips	acres	131	-----	3,186	251	55
Woodland Buffer Filter Area	acres	0	-----	0	0	0
Forest Harvesting	acres	3,554	70.0%	15,667	242	366
Animal Waste Control Facilities	systems	3	-----	3,613	277	0
Poultry Waste Control Facilities	systems	0	-----	0	0	0
Loafing Lot Management	systems	0	-----	0	0	0
Erosion & Sediment Control	acres	891	69.6%	82,423	3,388	695
Urban SWM/BMP Retrofits	acres	197	0.9%	206	7	8
Urban Nutrient Mgmt / Land Retire	acres	500	0.1%	1,626	95	5
Septic Pumping	systems	pending	----	0	0	0
Shoreline Erosion Protection	linear feet	13,444	----	16,527	10,838	412
			Total Pounds Reduced:	358,813	35,910	4,971
			Adjustment for Land Use Changes:	83,114	106	(1,820)
			Adjusted Reduction:	275,699	35,804	6,791
			Nonpoint Controllable Amount:	2,305,357	145,695	27,976

Percent Reduction:	12.0%	24.6%	24.3%

Nutrient Control Options

Results of Future Reduction Targeting Exercise

Several regional brainstorming meetings were held in March 1998 to identify reasonable management targets for typical BMP treatments that could be achieved if sufficient resources were provided. These targets were then interpolated on a per year basis to determine a relative level of effort needed by the years 2000, and 2005, to achieve an identified goal in 2010. This exercise was done to provide a framework for understanding the level of effort needed and to assist in stakeholder planning and resource acquisition. In the final strategy, targets were extrapolated for the years 2000, 2004, and 2010. This change was made because the strategy will undergo an evaluation in the year 2004 of progress towards full implementation of the management measures.

At this time, the interpolation of outlying years identifies only pounds reduced and does not take into account any loading adjustments based on growth related land conversions or increased point source flows. The EPA Bay Program has not projected land use beyond 2000, so comparable percent reductions of nutrients and sediments delivered to the Bay cannot be determined at this time. This information will be updated when the strategy undergoes a review.

It is also important to note that these targets represent regional targets and are not broken down by each individual locality. The raw regional targets for the Lower York include the Western Coastal Basins of Mobjack Bay and the Piankatank River and are not separated as in the previous reduction tables.

The following raw targets were suggested by stakeholders in attendance at the March 1998 meetings held at Lake Anna.

UPPER BASIN 2010 TARGET SCENARIO

BMP Type	58%	75%
Farm Plans	1%	5-7%
Land Retirement	10%	15%
Ag. Nutrient Management	0%	100%
Urban Nutrient Mgmt.	unknown	unknown
Stream Protection	2.7%	10%
Grazing Land Protection	1.6%	85%
Cover Crops	<1%	50%
Grass Filter Strips	0%	10% of needed
Woodland Buffer Filter	70%	80%
Forest Harvesting BMP	-	?
Animal Waste Fac	-	?
Poultry Waste Fac	69.9%	100%
Erosion & Sediment Cntrl.		
Stormwater Management	0%	10%
Shoreline Erosion Pro.	unknown	95% of needed
Current	**Year 2010 Goal**	

The information provided above from the target setting exercise was then extrapolated in the Initial Strategy using a simple linear projection to develop tables for the year 2000, 2005, and 2010. Since forecasting was not available for future point source flows, this information was developed only for nonpoint source BMPs.

These targets were amended in 1999 for the Final Strategy, based on additional stakeholder comment calling for additional urban BMP targets. Extrapolations in the following tables are for the years 2000, 2004, and 2010.

Nonpoint Source BMPs for Upper York Region: 2000

Based on Projections as provided by Tributary Team

		Year 2000 Projected		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	71,261	49.8%	22,286	5,441	3,845
Nutrient Management	acres	8,792	11.0%	5,068	364	0
Agricultural Land Retirement	acres	2,806	2.0%	11,206	2,075	1,349
Grazing Land Protection	acres	2,557	4.0%	3,967	121	0
Stream Protection	acres	57	----	83	8	5
Cover Crops	acres	5,389	16.0%	21,471	1,115	889
Grass Filter Strips	acres	85	----	636	97	62
Woodland Buffer Filter Area	acres	1	----	6	1	1
Forest Harvesting	acres	1,977	70.0%	5,455	203	384
Animal Waste Control Facilities	systems	2	----	2,183	109	0
Poultry Waste Control Facilities	systems	7	----	531	67	0
Loafing Lot Management	systems	0	----	0	0	0
Erosion & Sediment Control	acres	909	70.0%	17,266	744	490
Urban SWM/BMP Retrofits	acres	693	1.7%	2,413	316	144
Urban Nutrient Management	acres	0	----	0	0	0
Septic Pumpouts	systems	0	----	0	0	0
Shoreline Erosion Protection	linear feet	0	----	0	0	0
Nontidal Stream Protection	acres	0	----	0	0	0
			Reductions:	92,571	10,661	7,169

Nonpoint Source BMPs for Upper York Region: 2004

Based on Projections as provided by Tributary Team

		Year 2004 Projected		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	89,294	62.4%	27,926	6,818	4,819
Nutrient Management	acres	10,386	13.0%	5,986	430	0
Agricultural Land Retirement	acres	6,384	4.5%	25,495	4,721	3,069
Grazing Land Protection	acres	4,460	7.0%	6,918	211	0
Stream Protection	acres	57	----	83	8	5
Cover Crops	acres	16,847	50.0%	67,119	3,485	2,778
Grass Filter Strips	acres	102	----	759	116	74
Woodland Buffer Filter Area	acres	1	----	6	1	1
Forest Harvesting	acres	1,977	85.0%	6,624	246	466
Animal Waste Control Facilities	systems	2	----	2,183	109	0
Poultry Waste Control Facilities	systems	7	----	531	67	0
Loafing Lot Management	systems	0	----	0	0	0
Erosion & Sediment Control	acres	909	77.5%	19,116	824	542
Urban SWM/BMP Retrofits	acres	1,366	3.4%	4,754	623	284
Urban Nutrient Management	acres	125	0.6%	50	5	0
Septic Pumpouts	systems	524	2.5%	83	0	0
Septic Connections	systems	25	0.1%	44	0	0
Shoreline Erosion Protection	linear feet	0	----	0	0	0
Nontidal Stream Protection	acres	5	----	9	1	0
			Reductions:	167,686	17,664	12,039

Nonpoint Source BMPs for Upper York Region: 2010

Based on Projections as provided by Tributary Team

		Year 2010 Projected		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	107,328	75.0%	33,565	8,195	5,792
Nutrient Management	acres	11,980	15.0%	6,905	496	0
Agricultural Land Retirement	acres	9,962	7.0%	39,783	7,366	4,790
Grazing Land Protection	acres	6,363	10.0%	9,870	300	0
Stream Protection	acres	57	---	83	8	5
Cover Crops	acres	28,641	85.0%	114,110	5,925	4,724
Grass Filter Strips	acres	117	---	876	134	86
Woodland Buffer Filter Area	acres	1	---	6	1	1
Forest Harvesting	acres	1,977	100.0%	7,793	290	549
Animal Waste Control Facilities	systems	2	---	2,183	109	0
Poultry Waste Control Facilities	systems	7	---	531	67	0
Loafing Lot Management	systems	0	---	0	0	0
Erosion & Sediment Control	acres	909	85.0%	20,996	904	595
Urban SWM/BMP Retrofits	acres	2,039	5.0%	7,096	930	424
Urban Nutrient Management	acres	250	1.2%	99	9	0
Septic Pumpouts	systems	1,048	5.0%	167	0	0
Septic Connections	systems	50	0.2%	87	0	0
Shoreline Erosion Protection	linear feet	0	---	0	0	0
Nontidal Stream Protection	acres	10	---	18	1	0
			Reductions:	244,138	24,735	16,963

The following raw targets were suggested by stakeholders in attendance at the March 1998 meetings held at Ashland.

CENTRAL BASIN 2010 TARGET SCENARIO

BMP Type	245	50-60%
Farm Plans	64 acres	add 64 more acres
Land Retirement	<1%	will decrease**
Nutrient Management	4.4%	add 3000 acres
Stream Protection	1%	add 270 acres
Grazing Land Protection	0%	no change
Cover Crops	70%	85%
Grass Filter Strips	1	5 facilities
Woodland Buffer Filter		
Forest Harvesting BMP	-	no change anticipated
Animal Waste Control Fac		
Poultry Waste Control Fac	69.6%	85%
Erosion & Sediment Cntrl.		
Stormwater Management	unknown	50% of plan implemennted+
		unknown: 20-90%
Shoreline Protection	unknown	
Septic Pumpout	10%	* in other vegetative practices like
Current	**Year 2010 Goal**	SL1, SL11, FR4
30%	add 1000 acres	**under current federal policy it is
1.6%	add 200 acres*	believed that this will decrease

+50% of Hanover County regional stormwater plan implemented

Nonpoint Source BMPs for Central York Region: 2000
Based on Projections as provided by Tributary Team

The information provided above from the target setting exercise was then extrapolated in the Initial Strategy using a simple linear projection to develop tables for the year 2000, 2005, and 2010. Since forecasting was not available for future point source flows, this information was developed only for nonpoint source BMPs.

These targets were amended in 1999 for the Final Strategy, based on additional stakeholder comment calling for additional urban BMP targets. Extrapolations in the following tables are for the years 2000, 2004, and 2010.

		Year 2000 Projected		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	37,815	30.5%	30,618	9,084	4,049
Nutrient Management	acres	28,905	30.0%	49,806	3,426	0
Agricultural Land Retirement	acres	2,518	2.0%	14,250	2,175	938
Grazing Land Protection	acres	446	1.6%	833	17	0
Stream Protection	acres	74	——	225	7	6
Cover Crops	acres	3,643	5.0%	15,712	710	237
Grass Filter Strips	acres	395	——	6,408	574	145
Woodland Buffer Filter Area	acres	0	——	0	0	0
Forest Harvesting	acres	4,596	70.0%	16,689	268	6016
Animal Waste Control Facilities	systems	2	——	2,174	141	0
Poultry Waste Control Facilities	systems	2	——	478	30	0
Loafing Lot Management	systems	0	——	0	0	0
Erosion & Sediment Control	acres	496	70.0%	26,287	1,021	240
Urban SWM/BMP Retrofits	acres	0	0.0%	0	0	0
Urban Nutrient Management	acres	0	0.0%	0	0	0
Septic Pumpouts	systems	0	——	0	0	0
Septic Connections	systems	0	——	0	0	0
Shoreline Erosion Protection	linear feet	0	——	0	0	0
Nontidal Streambank Restoration	acres	0	——	0	0	0
			Reductions:	163,478	17,455	6,214

Nonpoint Source BMPs for Central York Region: 2004

Based on Projections as provided by Tributary Team

		Year 2004 Projected		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	38,230	30.9%	30,954	9,184	4,093
Nutrient Management	acres	43,354	45.0%	74,701	5,139	0
Agricultural Land Retirement	acres	2,602	2.1%	14,726	2,248	969
Grazing Land Protection	acres	446	1.6%	833	17	0
Stream Protection	acres	100	——	304	10	8
Cover Crops	acres	4,963	6.8%	21,406	967	323
Grass Filter Strips	acres	536	——	8,653	776	195
Woodland Buffer Filter Area	acres	0	——	0	0	0
Forest Harvesting	acres	4,596	85.0%	20,265	325	729
Animal Waste Control Facilities	systems	4	——	4,349	283	0
Poultry Waste Control Facilities	systems	2	——	478	30	0
Loafing Lot Management	systems	0	——	0	0	0
Erosion & Sediment Control	acres	496	77.5%	29,103	1,131	266
Urban SWM/BMP Retrofits	acres	8,556	20.0%	29,775	3,902	1,780
Urban Nutrient Management	acres	375	1.8%	357	32	0
Septic Pumpouts	systems	927	5.0%	328	0	0
Septic Connections	systems	100	0.5%	389	0	0
Shoreline Erosion Protection	linear feet	0	——	0	0	0
Nontidal Streambank Restoration	acres	13	——	52	4	0
			Reductions:	236,673	24,046	8,363

Nonpoint Source BMPs for Central York Region: 2010

		Based on Projections provided by Tributary Team				
	Year 2010 Projected			Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	38,649	31.2%	31,293	9,284	4,138
Nutrient Management	acres	57,802	60.0%	99,596	6,851	0
Agricultural Land Retirement	acres	2,685	2.2%	15,196	2,320	1,000
Grazing Land Protection	acres	446	1.6%	833	17	0
Stream Protection	acres	127	—	384	12	10
Cover Crops	acres	6,210	8.5%	26,785	1,210	404
Grass Filter Strips	acres	674	—	10,953	982	247
Woodland Buffer Filter Area	acres	0	—	0	0	0
Forest Harvesting	acres	4,596	100.0%	23,841	383	858
Animal Waste Control Facilities	systems	6	—	6,523	424	0
Poultry Waste Control Facilities	systems	2	—	478	30	0
Loafing Lot Management	systems	0	—	0	0	0
Erosion & Sediment Control	acres	496	85.0%	31,920	1,240	291
Urban SWM/BMP Retrofits	acres	17,112	40.0%	59,550	7,803	3,559
Urban Nutrient Management	acres	750	3.6%	714	64	0
Septic Pumpouts	systems	1,854	10.0%	655	0	0
Septic Connections	systems	200	1.1%	778	0	0
Shoreline Erosion Protection	linear feet	0	—	0	0	0
Nontidal Streambank Restoration	acres	25	—	105	7	0
			Reductions:	309,604	30,628	10,508

The following raw targets were suggested by stakeholders in attendance at the March 1998 meetings held at Gloucester Point (VIMS).

LOWER BASIN 2010 TARGET SCENARIO

BMP Type	Current	Year 2010 Goal
Farm Plans	78%	90-95%
Land Retirement	1.6%	15%
Nutrient Management	255	80%
Stream Protection	9 acres	up to 200 acres
Grazing Land Protection	<1%	5%
Cover Crops	<1%	2%
Grass Filter Strips	1%	2%
Woodland Buffer Filter	0%	add 100 acres
Forest Harvesting BMP	70%	95%
Animal Waste Control Fac	-	5 facilities
Poultry Waste Control Fac	-	no change anticipated
Erosion & Sediment Cntrl	65%	95%
Stormwater Management	10%	40%
Shoreline Protection	pending	-
Septic Pumpout	1%	95%

The information provided above from the target setting exercise was then extrapolated in the Initial Strategy using a simple linear projection to develop tables for the year 2000, 2005, and 2010. Since forecasting was not available for future point source flows, this information was developed only for nonpoint source BMPs.

These targets were amended in 1999 for the Final Strategy, based on additional stakeholder comment calling for additional urban BMP targets. Extrapolations in the following tables are for the years 2000, 2004, and 2010.

Nonpoint Source BMPs for Lower York Region: 2000

Based on Projections as provided by Tributary Team

BMP Treatment	units	Coverage (Year 2000 Projected)	Percent (Year 2000 Projected)	Nitrogen (Reductions, lbs or tons per year)	Phosphorus (Reductions, lbs or tons per year)	Sediment (Reductions, lbs or tons per year)
Farm Plans	acres	86,648	51.9%	107,686	20,759	6,988
Nutrient Management	acres	50,698	35.0%	238,740	7,556	0
Agricultural Land Retirement	acres	6,411	3.8%	99,517	7,575	2,218
Grazing Land Protection	acres	527	2.4%	1,347	9	0
Stream Protection	acres	41	----	160	2	2
Cover Crops	acres	3,590	2.7%	24,155	815	277
Grass Filter Strips	acres	196	----	5,131	429	128
Woodland Buffer Filter Area	acres	21	----	622	57	23
Forest Harvesting	acres	5,392	70.0%	24,996	371	752
Animal Waste Control Facilities	systems	4	----	4,817	369	0
Poultry Waste Control Facilities	systems	0	----	0	0	0
Loafing Lot Management	systems	0	----	0	0	0
Erosion & Sediment Control	acres	1,151	70.0%	98,530	3,923	910
Urban SWM/BMP Retrofits	acres	2,680	8.0%	5,538	338	208
Urban Nutrient Mgmt	acres	500	2.9%	937	86	0
Marina Pumpout	systems	29	85.3%	1,291	544	0
Septic Pumpouts	systems	0	----	0	0	0
Septic Connections	systems	0	----	0	0	0
Shoreline Erosion Protection	linear feet	31,280	----	7,194	5,943	11,573
Nontidal Stream Protection	acres	0	----	0	0	0
			Reductions:	620,661	48,776	23,080

Nonpoint Source BMPs for Lower York Region: 2004

Based on Projections as provided by Tributary Team

BMP Treatment	units	Coverage (Year 2004 Projected)	Percent (Year 2004 Projected)	Nitrogen (Reductions, lbs or tons per year)	Phosphorus (Reductions, lbs or tons per year)	Sediment (Reductions, lbs or tons per year)
Farm Plans	acres	122,721	73.5%	152,518	29,401	9,898
Nutrient Management	acres	82,607	57.0%	389,002	12,312	0
Agricultural Land Retirement	acres	15,596	9.3%	242,105	18,429	5,395
Grazing Land Protection	acres	791	3.6%	2,021	13	0
Stream Protection	acres	120	----	466	6	5
Cover Crops	acres	4,141	3.1%	27,863	940	319
Grass Filter Strips	acres	197	----	5,157	431	129
Woodland Buffer Filter Area	acres	60	----	1,773	162	66
Forest Harvesting	acres	5,392	82.5%	29,459	437	887
Animal Waste Control Facilities	systems	5	----	6,021	462	0
Poultry Waste Control Facilities	systems	0	----	0	0	0
Loafing Lot Management	systems	0	----	0	0	0
Erosion & Sediment Control	acres	1,151	77.5%	109,086	4,343	1,007
Urban SWM/BMP Retrofits	acres	6,371	19.0%	13,168	803	496
Urban Nutrient Mgmt	acres	1,000	5.8%	1,875	171	0
Marina Pumpout	systems	31	91.2%	1,475	622	0
Septic Pumpouts	systems	1,598	5.0%	685	0	0
Septic Connections	systems	100	0.3%	472	0	0
Shoreline Erosion Protection	linear feet	96,100	----	22,103	18,259	35,557
Nontidal Stream Protection	acres	25	----	207	15	1
			Reductions:	1,005,457	86,807	53,759

Nonpoint Source BMPs for Lower York Region: 2010

Based on Projections as provided by Tributary Team

		Year 2010 Projected		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	158,628	95.0%	197,143	38,003	12,793
Nutrient Management	acres	115,967	80.0%	546,094	17,285	0
Agricultural Land Retirement	acres	25,116	15.0%	389,878	29,678	8,688
Grazing Land Protection	acres	1,098	5.0%	2,806	18	0
Stream Protection	acres	200	----	777	10	8
Cover Crops	acres	4,790	3.5%	32,234	1,088	370
Grass Filter Strips	acres	199	----	5,210	435	130
Woodland Buffer Filter Area	acres	100	----	2,953	270	110
Forest Harvesting	acres	5,392	95.0%	33,923	503	1,021
Animal Waste Control Facilities	systems	6	----	7,225	554	0
Poultry Waste Control Facilities	systems	0	-----	0	0	0
Loafing Lot Management	systems	0	----	0	0	0
Erosion & Sediment Control	acres	1,151	85.0%	119,643	4,763	1,105
Urban SWM/BMP Retrofits	acres	10,063	30.0%	20,799	1,268	783
Urban Nutrient Mgmt	acres	1,500	8.6%	2,812	257	0
Marina Pumpouts	systems	34	100.0%	1,752	739	0
Septic Pumpouts	systems	3,196	10.0%	1,370	0	0
Septic Connections	systems	200	0.6%	943	0	0
Shoreline Erosion Protection	linear feet	192,200	----	44,206	36,518	71,114
Nontidal Stream Restoration	acres	50	----	414	29	1
			Reductions:	1,410,182	131,419	96,123

Results of Regional "Ideal" Scenario Exercise

As part of the March 1998 brainstorming exercise, stakeholders were asked: If resources were not an issue, what would be the most important BMP that you could implement in your area that would reduce nutrients. The tables that follow could be interpreted as preferred or most effective scenarios as interpreted by the stakeholders. No attempt has been made to date to try to quantify the reduction levels or costs associated with this scenario.

UPPER YORK IDEAL SCENARIO

Albemarle: Better land use planning by reducing new road construction and sprawl
Goochland: Build better buffers
Fluvanna: Increase implementation of cattle management BMPs
Louisa: Institute programs to accelerate the preservation of land including PDR programs, more use of conservation easements, and tax incentives
Orange: Did Not Respond
Spotsylvania: Apply 100-foot Resource Protection Area buffer to intermittent headwater streams (in the York basin portion of the county)
Tri-County City SWCD: Install shoreline erosion control on Lake Anna
Culpeper SWCD: Agricultural nutrient management plans on all practical acreage (75% coverage in district)
Thomas Jefferson SWCD: Better land use planning

CENTRAL YORK IDEAL SCENARIO

Caroline: Increased technical resources for management of Bay related activities
Hanover: Increase E&S enforcement to 85% or better
Hanover-Caroline SWCD: 1) increase nutrient management (Ag and urban), and, 2) increase application of Grazing Land Protection practices

LOWER YORK IDEAL SCENARIO

Essex: Regional stormwater management, including retrofits of highway and commercial projects not previously managed for water quality
Gloucester: Urban nutrient management on urban acres
James City: Retire highly erodible soils from agricultural production and development
King and Queen: Educational programs and increased erosion and sediment control resources
King William: 100% Forestry BMP implementation
Mathews: Agricultural planning (farm plans) on all acres
Middlesex: Did Not Respond
New Kent: Agricultural planning on all acres
Williamsburg: Implement adopted Regional Stormwater Program (includes retrofits within York River basin)
York: Regional Stormwater Management
Colonial SWCD: Use innovative BMPs and BMP systems more
Three Rivers SWCD: Animal waste control facilities
Tidewater SWCD: Nutrient Management
HRSD: Address I & I problem at West Point STP

Results of Stakeholder Needs Assessment Exercise
(in reference to improving the use/coverage of identified BMPs including the need for resources to advance a viable voluntary strategy effort)

A critical part of the initial strategy development process was the identification by stakeholders of prerequisite needs to accomplish the goals of the scenarios developed. What follows are summary responses by region to the need for legislative, policy, fiscal, and human resource needs to achieve the goals for each BMP type identified.

Stakeholder Needs To Accomplish Goals: Upper York

BMP Type	Legislation	Policy Shifts	Money	Staff
Farm Plans		yes, add WLP to cost-share	3 years @$5,000	yes, SWCD
Land Retirement	yes, PDR tax credit program	need to address conversion of resource land		yes, local government
Nutrient Mgmt.	yes, mandatory	yes		yes, DCR
Nut. Mgmt (urban)	yes, mandatory	yes		yes, local government
Stream Protection			rate is ok, need more available	yes, SWCD
Grazing Land Protection		rate is ok, need	more available	
Cover Crops				
Grass Filter Strips				
Woodland Buffer Filter				
Forestry BMPs	maybe need	yes, more DOF		yes, at DOF

Stakeholder Needs To Accomplish Goals: Central York

BMP Type	Legislation	Policy Shifts	Money	Staff
Farm Plans		yes, more local government role		yes, SWCD
Land Retirement	yes, create state CRP program	use tax credits	increase federal rate per acre	yes, SWCD
Nutrient Mgmt.		Yes, expand who can do plan for tax credit program		yes, SWCD and DCR
Stream Protection				
	to require	follow-up inspections		
Animal Waste Facilities				
Poultry Waste Facilities				
Erosion and Sedinent Control	yes, more state oversight	yes		DCR?
Shoreline Protection				

Grazing Land Protection	yes, current	DCR/NRCS spec. has disincentive effect		yes, SWCD
Cover Crops				
Grass Filter Strips				
Woodland Buffer Filter				yes, SWCD
Forestry BMPs	yes, tax credits for pre-harvest planning			yes, DOF
Animal Waste Facilities			Increase percentage of cost-share	yes, SWCD
Poultry Waste Facilities				
Erosion and Sediment Control				yes, local

Stakeholder Needs To Accomplish Goals: Lower York and Coastal Basins

BMP Type	Legislation	Policy Shifts	Money	Staff
Farm Plans		yes, simplify process and be more flexible on BMP specs	more incentive money needed	yes, SWCD government inspectors
Shoreline Protection				
Land Retirement	yes, enable local PDR programs		increase federal rate per acre	
Septic Pumpout		provide stronger evidence of nitrogen and phosphorous reductions.		
Nutrient Mgmt.		Yes, provide precision farming technical assistance	provide money for tissue and soil tests	yes, SWCD
Nut. Mgmt. (urban)	yes, require certification of	need to focus on more than just	more incentive money is needed	yes, local government

	commercial applicators	lawn care: ex. Plans on public lands		
Stream Protection		yes, allow cost-share of maintenance costs		
Grazing Land Protection		one time cost-	share increase	
Cover Crops		more education	increase money per acre	
Grass Filter Strips	need to change	marketing to wildlife focus and increase flexibility of specs		
Woodland Buffer Filter	adopt CRP type	program but for longer period of time, allow spec to change over time		
Forestry BMPs	yes, require plan showing BMPs			yes, DOF
Animal Waste Facilities	need to address	increase in equine wastes		
Erosion and Sediment control		make greater use of local civil penalty authority		yes, local government
Shoreline Protection	make eligible for	cost-share		
Stormwater Mgmt.		Shift emphasis to maintenance	money for capital improvements needed	yes, local government
Septic Pumpout		state needs to enforce stronger		yes, local government

Evaluation of Interim 40% Scenario and the Limits of Technology (LOT)

An interim 40% goal for the reduction of nitrogen and phosphorous was set for the lower Virginia Tributaries as part of the 1992 Bay Program re-evaluation process. Data from watershed model Limit of Technology (LOT) runs (May 7, 1998) were presented to state staff in early June, 1998 by the Bay Program. These runs looked at NPS LOT, PS LOT and total LOT in the York River.

LOT scenarios describe the maximum level of control using existing programs and technology. The LOT Point Source defines the maximum point source controls under the year 2000 projected conditions and assumes a point source discharge concentration of .075 mg/l for phosphorus and 3.0 mg/l for nitrogen. The LOT nonpoint source scenario provides an estimate of the maximum level of nonpoint source controls on urban and agricultural sources including maximum levels of urban best management practices, stormwater management, septic system controls, conservation tillage, farm plans nutrient management, riparian buffers, pasture fencing, cover crops, and forestry best management practices. To estimate the level of control possible for all sources, including point sources, nonpoint sources and air deposition of nitrogen, the LOT ALL scenario is used. This scenario assumes that the Ozone Transport Commission (OTC) levels of control are used on all stationary sources (within the Bay Basin) of nitrogen deposition, implementation of the national Low Emission Vehicle and High Enhanced Inspection and Maintenance standards in all 37 states in the Airshed Model domain for mobile sources.

According to the WSM, the interim nitrogen goal of 40% will not be achieved in the York Basin with LOT nonpoint source or LOT point source alone. It does appear that the 40% goal is theoretically achievable by implementing the LOT ALL scenario. However, the Bay Program has indicated that in the York Basin, because the LOT ALL scenario results in a load that is within 11% of the 40% goal, it will be extremely difficult to achieve. This difficulty is the result of the impracticality of achieving the level of implementation assumed by the LOT ALL scenario. It appears that such a strategy would not be cost-effective or practical.

Stakeholder and Basin Issues Identified by the Process

A number of policy and implementation issues were raised by stakeholders during this initial assessment process. The resolution of these issues by state and local decision-makers, the General Assembly, and state and local program managers are expected to be critical to the long term success of a tributary strategy effort of this kind. A summary of these issues follows:

- A number of stakeholders identified the alignment of political and water quality program management boundaries as an impediment to effective management of the river basin. To address this issue, several stakeholder groups have advocated the use of a watershed or sub-watershed approach to evaluating opportunities to identify nutrient reduction strategies that are the most effective given their location in the watershed, and that are most cost-effective.

- A key issue raised by local government stakeholders in the York basin relates to the division of localities by the various tributary drainage areas, and thus strategies, and the potential to have multiple pollution reduction goals in a locality.

- There was general consensus on the part of local government representatives that the implementation of forestry BMPs was less than the stated level of compliance and was an area that improvements could be obtained. Forestry is an important activity in the basin as it still heavily forested and there are significant land holdings by forest products companies. In addition, forestry activities are often a precursor to new residential development throughout the basin.

- Most local government representatives felt that there are opportunities to increase the effectiveness of existing nutrient reduction programs such as erosion and sediment control and stormwater management. In particular, local staff expressed resource issues as the primary limiting factor to achieving the level of implementation they would like to achieve. A number of these representatives indicated that there needs to be an evolution in these programs that emphasizes increased inspections and attention to facility maintenance.

- A concern was raised regarding local eligibility for financial assistance for refinements to existing programs required by existing state law. This concern focused primarily on the need for financial assistance to hire new local government staff for local erosion and sediment control, stormwater management and Chesapeake Bay Preservation Act (Bay Act) programs. This concern was also raised by urban localities required to meet NPDES stormwater requirements.

- In addressing loadings from agricultural sources in the basin, there seemed to be general consensus that progress was being made and that opportunities are available to increase nutrient reductions. However, soil and water conservation districts clearly stated that increases and stabilization of funding to districts, changes in agricultural program policy, and a greater role in prioritizing nutrient reduction efforts are important factors in addressing the identified opportunities.

- Stakeholders raised concerns about the efficacy of septic pumpout programs in reducing nutrients. A number of local staff felt that there was not a strong enough scientific basis for reducing nutrients for pumpout programs to be a viable cost-effective management option. Also in regard to septic issues, some stakeholders, particularly the Middle Peninsula Nutrient Reduction Task Force, suggested that the Bay Act pump-out standard would be more effective if shifted to local Health Departments rather than local planning or development review departments.

- Stakeholders in Tidewater expressed concerns that the effective management of the water quality issues in the York basin was not likely without expanding the Chesapeake Bay Preservation Act (Bay Act) to localities in the upper portions of the watershed. The Bay Act was acknowledged by most stakeholders as a useful nonpoint source management tool that should be applied basin-wide.

IV. COMPLETION OF A FINAL STRATEGY

Challenges and Opportunities

Living Resources. No quantitative goals could be developed in the 1998 initial strategy draft, although two speculations were relevant. First, the restoration of SAV in the middle tidal reaches of the York will probably require achievement of conditions better than the current targeting suggests. This is because the extant habitat requirement conditions address sustaining existing populations; successful establishment in new areas may require relief from the pressures of transient conditions which can be tolerated by established communities. In essence, successful invasion of a new area by SAV is unlikely to occur at the margins of tolerance; conditions will have to be made better than tolerable. Second, the absence of a clear response of the phytoplankton community to changes in nutrient loads suggests that we have not yet approached the level of change necessary to see beneficial impacts in the system.

There are some other management conundrums raised by the York system. While conditions in the middle tidal reach are now apparently dominated by the high level of physical energies operating in the system, the presence of relic oyster bars indicates that this does not eliminate the possibility of a diverse community of living resources. It remains to be determined what combination of habitat structure and water quality conditions must be restored to allow the system to become self-sustaining.

One information need which appears critical to understanding the responses of living resources to system conditions is more extensive seasonal trend information of all monitored constituents. Annual averages conceal too much information to allow effective linking of habitat conditions and living resource responses.

Steps that Followed the Initial Strategy

The initial strategy represented the first step in what will likely be an on-going process. The first step we undertook was to familiarize ourselves with the River, understand each stakeholders data and programs, assess the extent of these programs to the best of our ability, and project options for potential opportunities for nutrient reductions and resource needs. As such, the Initial York River Tributary Strategy was an important step in developing a plan for improving water quality in the York River that is based on sound science and supported by stakeholders. A number of challenges remained however, before a final strategy could be completed. These challenges could be grouped into two major tasks, goal setting, and selecting specific actions to meet the goals. In order to complete the strategy, and begin implementation as soon as possible, these tasks were undertaken concurrently.

Goal Setting

The strategy development process in the York River basin focused on setting quantitative goals for reducing pollutants to predetermined levels once the results from the Chesapeake Bay Program Water Quality Model were received. Prior to receipt of the model results, habitat objectives were used as a starting point for this discussion.

The Chesapeake Bay Program has developed several water quality objectives that are being used in the development of strategies for each of Virginia's tributaries. These objectives provide the primary scientific context in which nutrient reduction goals for each of the tributaries have been established. These water quality objectives represent guideposts for improving, maintaining, and protecting the aquatic ecosystem habitat of the Chesapeake Bay and its tidal tributaries. They depict the current best scientific understanding of the water conditions necessary for a balanced estuarine ecosystem, one that will support healthy aquatic life communities, including the bottom-dwelling benthic community and submerged aquatic vegetation (SAV). Details for the assessment and determination of these water quality objectives are provided in Chesapeake Bay Program (1993), Dennison *et al*. (1993), Batiuk *et al*. (1992), Jordan *et al*. (1992) and Funderburk *et al.* (1991).

The principal water quality parameters of interest are: dissolved oxygen (DO), dissolved inorganic nitrogen (DIN), dissolved inorganic phosphorus (DIP), phytoplankton chlorophyll *"a"*, light attenuation coefficient (Kd) and total suspended solids (TSS).

Dissolved oxygen is a major factor affecting the survival, distribution, and productivity of living resources in the aquatic environment. Because of the natural fluctuations of DO, and the varied ability of the many key Bay species to tolerate less than desirable DO concentrations, habitat requirements for DO cannot be stated as a single, critical concentration. The sensitivity of each species to low DO depends upon life cycles, temperatures, salinity, duration of exposure, and other stress factors, such as contaminants. By selecting conditions acceptable for the reproduction, growth, and survival of a variety of sensitive species, habitat requirements can be established that will also protect the Bay's other living resources. Dissolved oxygen tolerance information was compiled and interpreted for fourteen target species of fish, molluscs, and crustaceans as reported in Funderburk et al. (1991), including both commercial and recreational fish and shellfish. The DO goals are summarized below:

Summary of Dissolved Oxygen Goals[1]

Dissolved Oxygen Goal	**Location & Other Specifications**
At least 1.0 mg/l at all times including subpycnocline waters	Throughout the Bay and tidal tributaries,
Between 1.0-3.0 mg/l for less than 12 between 1.0-3.0 mg/l longer than 48 hours	Throughout the Bay and tidal tributaries, hours and interval including subpycnocline waters
Monthly mean of 5.0 mg/l or better at all times	All times throughout waters above the pycnocline
At least 5.0 mg/l at all times in spawning reaches, spawning rivers, and	Throughout the water above the pycnocline nursery areas.

Exposure to low dissolved oxygen (DO < 0.5-1.5 mg/l) concentrations have been found lethal, during some life stages, to all of the target species for which exposure information was available. While many species can live in waters with severely depressed (or hypoxic) dissolved oxygen condition (between 1.5 and 3.0 mg/l) deleterious effects were found with growth and reproduction severely compromised.

Submerged aquatic vegetation (SAV) refers to underwater vascular plants. This aquatic vegetation performs a number of valuable ecological roles in Chesapeake Bay. The plants are major food for waterfowl, and the beds provide habitat and shelter for a variety of fish, shellfish and many smaller organisms which in turn serve as food for the variety of other larger organisms, many of which are valued commercial and recreational fishes.

Historically, SAV has generally been abundant throughout the Chesapeake Bay; however, current populations are only a remnant of the once thick beds that provided shelter to the Bay's thriving fishery. The drastic decline of SAV, first noted in the 1970's, sparked the interests of Bay scientists and managers to determine the cause for this significant loss and seek methods to restore this dwindling resource.

[1] *See Chesapeake Bay Program (1993) and Jordan et al. (1992) for details.*

In order to provide an incremental measure of progress, the Chesapeake Bay Program established a tiered set of SAV distribution restoration targets. Each target represented an expansion in SAV distribution that was anticipated in response to improvements in water quality. **Tier I** describes SAV restoration to areas currently or previously inhabited by SAV as mapped through regional and baywide aerial surveys from 1971 through 1990. **Tier II** is restoration of SAV to all shallow water areas delineated as existing or potential SAV habitat down to the one meter depth contour. **Tier III** is restoration of SAV to all shallow water areas delineated as existing or potential SAV habitat down to the two meter depth contour.

A number of environmental benefits are anticipated from reducing the input of excessive levels of nutrients that currently flow into Virginia's Bay tributaries. Among those would be achieving the water quality objectives described above. Projected nutrient reductions have been linked to resulting water quality improvements, based on tributary specific water quality model simulations using the Chesapeake Bay Water Quality Model. These simulations have been the basic technical tool used to help determine the nutrient reduction goals needed for each tributary.

While not numeric goals per se, the results of the BMP targeting exercise resulted in projected nutrient and sediment reductions that served as the foundation for goals developed later.

Development of Goal Setting Tools

In addition, several initiatives were undertaken to provide the necessary information to assure that these goals are based on the best available science.

First, technical staff at the Chesapeake Bay Program continued to refine the Water Quality Model after the Initial Strategy was prepared to improve its capability to provide the most accurate information on the York River's response to varying levels of pollutant reduction. The predictive capacity of this model was critical to determining final goals. Numerous scenarios were tested with the Water Quality Model to try and define how the living resources in the York River respond to varying levels of nutrient and sediment reduction. Model runs continued for several months.

In an attempt to provide further stakeholder input into the goal setting process, a York River Technical Advisory Committee (Appendix F) was formed in the lower York by the Hampton Roads Planning District Commission during the summer of 1998. This Committee was assembled to provide broad stakeholder representation and to take advantage of the range of technical expertise available in the York River basin. However, stakeholders from the upper and central basin were never selected and the committee did not meet. Input was encouraged from stakeholders at a number of publicly held meetings.

It is the general consensus of Bay scientists that the recent loss of SAV in Chesapeake Bay is due to decreased light penetration throughout the water column and biofouling of the plant surfaces caused by excessive loadings of nutrients and sediments from the watershed. Excessive nutrients and sediments cause increases in turbidity, therefore, limiting light necessary for the plants to grow and reproduce. Habitat requirements most applicable to SAV are those water quality parameters that directly measure or contribute to limiting light conditions, including: dissolved inorganic nitrogen (DIN), dissolved inorganic phosphorus (DIP), total suspended solids (TSS), chlorophyll *"a"*, Secchi depth, and light attenuation (Kd). While light is the major parameter controlling SAV distribution, nutrients such as nitrogen and phosphorus, indirectly contribute to light attenuation by stimulating growth of algae in the water column and on the leaves and stems of SAV. Chlorophyll *"a"* is a measure of the amount of algal phytoplankton which contributes to decreased water clarity. Kd is a direct measure of water clarity. Together, these parameters provide for both a qualitative and quantitative measure of the available light to the SAV community.

SAV habitat requirements are defined as the minimal water quality levels necessary for SAV survival. The diversity of their communities coupled with their wide salinity ranges, has led to the establishment of separate requirements based on salinity. Habitat requirements are provided for both one meter and two meter depths for restoration. The SAV habitat requirements provided below were developed by Bay scientists several years ago. A team of scientists reviewed this list of habitat requirements. Their primary goal was to verify their previous studies, refine the requirements as warranted and develop additional diagnostic tools that will help manage this important resource.

SAV Habitat Requirements

One Meter Restoration

Water Quality Parameter	Value	Other Specifications
Light Attenuation (Kd) (m-1)	<2.0	For TF[1,2] and OL[1,2] regions
	<1.5	For ME[1,2] and PO[1,3]
Total Suspended Solids (mg/l)	<15	For TF[2], OL[2] & ME[2] regions and PO[3]
Chlorophyll *a* (ug/l)	<15	For TF[2], OL[2] & ME[2] regions and PO[3]
Dissolved Inorganic Nitrogen (mg/l)	<0.15	For ME[2] regions and PO[3]
Dissolved Inorganic	<0.02	For TF[2] & OL[2] and PO[3]
Phosphorus (mg/l)	<0.01	For ME[2] and PO[3]

Two Meter Restoration

Light Attenuation (Kd)	<0.8	For TF[2], OL[2] & ME[2] regions and PO[3]

[1]TF=Tidal Fresh (<0.5 ppt salinity), OL=Oligohaline (0.5 to 5.0 ppt salinity), ME=Mesohaline (5.0 to 18.0 ppt salinity) and PO=Polyhaline (>18 ppt salinity) [2]Critical Life Period for SAV is April through October [3]Critical Life Period for SAV is March through November

A second initiative involved gathering information necessary for goal setting through the Technical Synthesis Workshop held at the Virginia Institute of Marine Science in March, 1998. The objective of the meeting was to synthesize water quality information and provide links to living resource status and trends. Information from this workshop was compiled into tributary-specific storylines that were useful for goal setting.

A third initiative resulted in a set of planning tools provided to basin localities and SWCDs. Subwatershed land use mapping folios were provided to basin localities and districts by the York Watershed Council at their April 29, 1998 Conference. These maps proved useful to targeting cost-effective BMP implementation based on land uses at the subwatershed scale. Additional mapping for districts that spatially identifies agricultural BMP planning efforts at this same scale were also produced. This tool was significant for identifying unplanned tracts and prioritizing cost-share programs.

The Year 2010 Scenario Developed by Stakeholders

While awaiting the model runs and the resultant goals, a consensus on achievable nonpoint source measures was coordinated through the York Watershed Council, and agreed upon by participating stakeholders. This resulted in a scenario, now known as the "2010 Scenario," named for the target year these measures would be fully implemented. In response to a request from the Council, the EPA Bay Program ran the 2010 Scenario through its Water Quality Model. The results of this model run were presented to the Council and other stakeholders in March 1999. In accordance with Bay Program directives, reductions achieved by the 2010 Scenario will serve as interim caps. These caps are based on reductions from 1996 loads: a Nitrogen loading cap of 5.7 million pounds per year, a 2.3 million pound reduction; a phosphorus loading cap of 480,000 pounds per year, a 60,000 pound reduction; and a sediment loading cap of 155,000 tons per year, a 9,000 ton reduction. The 2010 Scenario was modified to also include a point source management measure after the model run was completed. No agreement has yet been reached with the point source representatives on the recommended point source management measure for the year 2010, which would achieve a Biologial Nutrient Removal (BNR) level of treatment for both municipal and industrial facilities with a flow capacity of 1 million gallons per day or greater. The BNR treatment level would result in lower annual average concentrations for nitrogen (8mg/l)and phosphorus (1.5 mg/l).

Selecting Actions to Reduce Nutrients and Sediments

The final strategy includes actions recommended by the stakeholders to meet the nutrient and sediment reduction goals established. The pollutant reduction options identified through the regional assessments for the Initial Strategy were refined and considered more thoroughly by stakeholders in the context of goal setting, based on the completed water quality model runs. The final strategy includes more information on each selected action including a recommended level of implementation, expected pollutant reduction, and costs. Actions have been selected based on their practicality, equity and cost effectiveness.

To meet the goals and caps suggested by the Water Quality Model of the Chesapeake Bay Program, reductions from both nonpoint and point sources are needed. Participation in the effort to successfully implement the Year 2010 Scenario in the York watershed is voluntary. Consequently, efforts will continue to be made to encourage the point source dischargers to contribute towards the nutrient reductions called for in the scenario.

If the nonpoint and point source management measures in the Year 2010 Scenario are fully implemented, they will result in significant improvements in water quality in the York watershed. The selected management measures of the Year 2010 Scenario, and the water quality improvements that would result from them, are outlined in tables that follow.

With the completion of a specific list of implementation actions to reach the pollutant reduction goals for the basin, the draft Final York River Strategy was made available for public input and for consideration by elected and appointed officials. Since that review, comments were considered and modifications made. This strategy will guide efforts in the watershed until it is revised in a few years to incorporate environmental endpoints (goals)that, when achieved, will result in the de-listing of the York and its tidal tributaries from the impaired waters list.

Point Source Issues

The listing of the tidal York River as an impaired water in the Spring of 1999 by the Environmental Protection Agency (EPA) means a TMDL (Total Maximum Daily Load) could be required by 2011 (see Section V). A TMDL on the York River could lead to amended permit limits in the future for point source dischargers in the York watershed. Also, EPA is working towards the development of nutrient criteria which might also affect discharge permits. Consequently, point sources in the York were not willing to commit to make capital investments to upgrade their plants at this time because such improvements might not satisfy possible EPA regulatory requirements several years from now.

In addition to permit concerns, point source representatives were concerned that BNR retrofits for existing wastewater treatment plants would not result in a significant positive response from living resources in the York watershed. A "point source only" model run will be incorporated into the strategy re-evaluation which will follow the development of "environmental endpoint" goals for the York River and its tidal tributaries, the Mattaponi and Pamunkey Rivers (see Section V).

The point source representatives agreed that the proposed flow threshold for implementing BNR retrofits would be raised from 500,000 to 1,000,000 gallons per day capacity. Approximately 95% of the total point source flow in the York watershed originates from facilities with a flow capacity of at least 1,000,000 gallons per day. To complement BNR retrofits at municipal wastewater treatment plants, the major industrial facilities in the watershed would achieve an equivalent treatment level. Industrial facilities could achieve a BNR-equivalent level of treatment by any means available, including implementation of pollution prevention measures to reduce nutrients in their industrial processes. All point source improvements would be completed by the year 2010. While the 1,000,000 gallon per day threshold would not emphasize smaller facilities for BNR retrofits, BNR at the targeted plants would improve treatment levels for more than 80% of both the point source nitrogen and phosphorus loads in the York River watershed.

Because of the concerns noted above, and the costs of implementation, even with 50% cost share grants from the Water Quality Improvement Fund (Fund) for voluntary point source treatment improvements, the point sources in the York watershed have not presently committed to this

management measure. Financial assistance from the Fund, through a competitive process, became available for all point source facilities in the York and Lower Coastal Basins, regardless of their size, in December 1999.

An Analysis of the Model Runs and the 2010 Scenario

Model runs by the Chesapeake Bay Program revealed that the water quality of the lower York River is significantly influenced by the water quality of the Rappahannock River,the northern tributaries of the Chesapeake Bay, and the Bay itself. The success of the collection of management measures, called the 2010 Scenario, is partly dependent on the successful implementation of nutrient and sediment reduction efforts north of the York River.

Reductions of nitrogen, phosphorus, and sediment, from sources within the York watershed are needed, along with efforts to achieve reductions north of the basin. Table 1 is a summary table of the management measures included in the 2010 Scenario. These actions if fully implemented, in concert with tributary strategies north of the basin, they would result in significant reductions in total nitrogen (30%), phosphorus (44%), and sediment (18%), compared to 1985 levels (Table 2). These reductions are projected to result in a decrease in anoxia (oxygen deficient water) by 47%, as well as a significant increase in Submerged Aquatic Vegetation (SAV) density in the York River and Mobjack Bay, estimated by the model to be 39%.

Table 3 shows projected loads in pounds of nitrogen and phosphorus, and tons of sediment. Comparing 1985 baseline to 1996 progress, it is clear that significant progress has already been made to reduce phosphorus and sediment in the watershed. Considerable reductions in nitrogen are needed to achieve the levels projected in the 2010 Scenario.

The model runs also revealed, that even if the current limit of technology were employed, some anoxia would continue to persist in the lower York River. This is due to the presence of a deep trough at the mouth of the river which restricts mixing over depth and leads to oxygen depletion in bottom waters.

Table 1: York Tributary Strategy

Year 2010 BMP Coverage Projections

BMP TYPE	UPPER BASIN	MIDDLE BASIN	LOWER BASIN
Farm Plans	75% = 107,328 acres	31.2% = 38,649 acres	95% = 158,628 acres
Land Retirement	7% = 9,962 acres	2.2% = 2,685 acres	15% = 25,116 acres
Agricultural Nutrient Management	15% = 11,980 acres	60% = 57,802 acres	80% = 115,967 acres
Urban Nutrient Management	250 acres	750 acres	1500 acres
Stream Protection	57 acres	127 acres	200 acres
Nontidal Stream Restoration	10 acres	25 acres	50 acres
Grazing Land Protection	10% = 6,363 acres	1.6% = 446 acres	5% = 1,098 acres
Cover Crops	85% = 28,641 acres	8.5% = 6,210 acres	3.5% = 4,790 acres
Grass Filter Strips	117 acres	674 acres	199 acres
Woodland Buffer Filter	1 acre	0	100 acres
Forest Harvesting BMP	100% = 1,977 acres	100% = 4,596 acres	95% = 5,392 acres
Animal Waste Control Facilities	2 systems	6 systems	6 systems
Poultry Waste Control Facilities	7 systems	2 systems	0
Erosion and Sediment Control	85% of disturbed lands controlled est. 909 acres	85% of disturbed lands controlled est. 496 acres	85% of disturbed lands controlled est. 1,151 acres
Urban Stormwater Management Retrofits	5% = 2,039 acres	40% = 17,112 acres	30% = 10,063 acres
Shoreline Protection	0	0	Total Entire Basin = 192,200 ft (19.1%)
Marina Pumpouts	0	0	(+5) = 34 systems
Septic Connections	50 systems	200 systems	200 systems
Septic Pumpout	5% = 1,048 systems	10% = 1,854 systems	10% = 3,196 systems

Point sources with flow capacity of 1,000,000 gallons/day or more will be asked to voluntarily employ at least the Biological Nutrient Removal (BNR) level of treatment by the Year 2010. Industrial facilities may reach BNR-equivalent via pollution prevention.

Table 2: **Tidal York and Western Shore Percent Improvement from 1985 Conditions for the Three Key Water Quality and Habitat Measurements**

Scenario	% Loading Reductions from 1985 Conditions			% Improvements of Water Quality and Living Resource from 1985 Conditions		
	Total Nitrogen %	Total Phosphorus %	Total Sediment % [1]	Anoxia < 1mg/L % [2]	Bay Grasses Area %	Bay Grass Density [3]
1996 Progress Whole Bay	2	36	16	13	1	22
VA 1996 Progress/Trib. Strategy Above	2	36	16	34	3	31
BNR+Equivalent/Trib. Strategy Above	28	41	15	44	4	36
Midpoint 1996-Full Voluntary Imp./Trib. Strat. Above	20	47	16	46	4	38
2010 Scenario	**30**	**44**	**18**	**47***	**5***	**39***
VA Interim Bay Agreement/Trib. Strat. Above	45	29	11	44	4	35
VA West Shore Full Voluntary Imp./Trib. Strat. Above	5	36	16	38	3	33
VA Full Voluntary/Trib. Strategy Above	38	56	21	49	7	41
Full Voluntary Implementation Whole Bay	38	56	21	72	7	49
Current Limit of Technology Whole Bay	48	68	32	80	9	54

Provided by the Virginia Department of Environmental Quality, July 27, 1999. Revised November 29, 1999.

Note: Tributary Strategy Above means that the loads from the Potomac River and above were held constant at agreed upon Tributary Strategy levels.

1. Total Sediment load did not include bank loads to tidal waters.

2. Anoxic water for the Tidal York under 1985 conditions was <1% of the total anoxic waters in Virginia.

3. Under maximum nutrient reductions, bay grass density attains 60 g C/m2 as compared to 50-100 g C/m2 for the Western and Eastern Shores.

* Living resource benefits of 2010 Scenario are estimates. 2010 Scenario is know to fall between BNR+Equivalent/Trib. Strategy Above and the Va Full Voluntary/Trib. Strategy Above scenarios.

Table 3: Tidal York Loads And Key Water And Habitat Quality Measurements [1]

Scenario	Loads						
	Nitrogen			Phosphorus			Sediment
	PS	NPS	Total	PS	NPS	Total	Total
	(mil. Lbs.)	(mil. Lbs.)	(mil. Lbs.)	(mil. Lbs.)	(mil. Lbs.)	(mil. Lbs.)	(mil. Tons)
1985 Baseline Conditions	1.3	6.9	8.2	0.42	0.44	0.85	0.19
1996 Progress	1.6	6.4	8	0.18	0.36	0.54	0.16
1996 Progress/Trib. Strat. Above	1.6	6.4	8	0.18	0.36	0.54	0.16
BNR-BNR Equivalent/Trib. Strat. Above	0.8	5.1	5.9	0.15	0.36	0.5	0.16
Interim Bay Agreement Goal/ Trib. Strat. Above			4.5			0.6	0.17
Midpoint 1996 - Full Volun. Imp.	1	5.5	6.6	0.11	0.34	0.45	0.16
2010 Scenario	**0.7**	**5**	**5.7**	**0.15**	**0.33**	**0.48**	**0.155***
West Shore Va Full Volun. Imp./ Trib. Strat. Above	1.6	6.2	7.8	0.18	0.36	0.54	0.16
Full Voluntary Imp./Trib Strat. Above	0.5	4.6	5.1	0.05	0.32	0.37	0.15
Full Voluntary Implementation	0.5	4.6	5.1	0.05	0.32	0.37	0.15
Current Limit of Technology	0.3	4	4.3	0.01	0.26	0.27	0.13

Information provided by the Department of Environmental Quality in July 1999. * Revised November 1999.

1. Data Includes loads and water and habitat quality responses for Western Shore York. Western Shore loads are 18/3% (TN), 9.8% (TP), and 18.8% (sediment) of the total York load for 1985 baseline conditions.

VA Agricultural BMP Cost Share and Grant Enhancement Recommendations for the York Watershed:

The following recommendations largely originated in 1998-1999, during the development of the Rappahannock Tributary Strategy. Because of similarities in agriculture (several Soil and Water Conservation Districts cover land area in both the Rappahannock and York River Basins), the Rappahannock list was used as a framework, then amended by the York Watershed Council and other stakeholders for the York Tributary Strategy at a meeting in July 1999:

- Provide cost share for Sidedress Application of Nitrogen on Corn and Late Winter Application of Nitrogen on Small Grains for farmers who are implementing a certified nutrient management plan.

- Provide cost share for Nutrient Management Plan Writing, to include the use of imported poultry litter and other biosolids and suitable materials.

- Provide cost share for soil testing in support of development, revision and implementation of nutrient management plans.

- Provide tax credit incentive for hay bale unrollers to more adequately distribute livestock feeding.

- Provide cost share for litter storage facilities on farms receiving imported litter. (Pad and tarp).

- Provide a per acre incentive payment for precision farming, variable N&P rates, for crops (including corn) based on soil type/expected yield, grid sampling and soil test levels.

- Cost-share for improvement of existing pastureland for farmers who develop and implement a rotational grazing plan. The plan would include soil testing, proper fertility rates, grazing management techniques, fencing, alternative watering and stocking rates etc.

- Cost-share on tissue testing in support of a nutrient management plan.

- Develop and cost share on BMPs targeted for horse owners who need assistance with pasture management, waste storage and composting.

- Cost-share on no-till small grain/continuous no-till in support of a conservation plan. Offer a $100/acre incentive payment to keep the continuous no-till system in place for five years.

- Provide cost share at $10 per acre for planting small grain that will be harvested (this crop contributes to erosion control and a certain amount of nutrient capture during the winter when potential for leaching and runoff is highest). This BMP must comply with VA Nutrient Management Standards and Criteria and be contained within a certified Nutrient Management Plan to qualify for cost share.

- Investigate and possibly add in accordance with a nutrient management plan an innovative BMP cattle feeding/waste storage facility (patterned after Maryland).

- To expand the Conservation Tillage Equipment Tax Credit criteria from only no-till planters and drills to include newer technology no-till equipment such as subsoilers, para tills and other equipment that leaves residue on the ground for no-till planting.

- Develop and fund a 75% cost share program or low interest loan program for streambank stabilization and riparian buffers for non-agricultural lands.

- Reduce or eliminate the $100.00 fee for NRCS, VCE and SWCD employees to become certified or recertified under the Nutrient Management Certified Planner Program.

- Provide a tax credit for landowners that implement Farm-A-Syst recommended BMPs.

- Higher level of cost-share for more expensive practices (i.e. rates and caps too low).

- Cost share wildlife BMP for Field Border (WL-1).

- Cost share erosion and sediment control on farm roads.

- Cost share idle cover crop, to enhance biomass, for one year.

Other Recommendations:

- Homeowner/suburban BMPs (e.g. cost-share construction costs of single lot infiltration devices).

- Increase opportunities for grants for erosion and sediment control, ordinance development, construction, monitoring, efforts to increase public involvement, and wetland mitigation, all in association with implementation of regional stormwater management.

- Grants for urban stream restoration.

- Grants for continued enhancement of local government maps and Geographical Information Systems (GIS) to enable better management of urban projects and program implementation in stormwater, erosion and sediment control, wetland restoration, and possibly TMDL development.

- 75% cost share for residential septic pumpout, limited to once every five years.

- 75% cost share for the installation of a Zabel or sand trap effluent filter on a residential septic tank.

- 50% cost share the price of lawn fertilizer if the user attends a water-wise gardener of Virginia Cooperative Extension program that teaches proper lawn care nutrient management in the same calendar year as the fertilizer application.

- 50% cost share for gutter runnels to direct roof runoff away from paved, highly erodible, or sloped areas and to establish buffer strips between lawns and water bodies.

Outreach And Education:

- Develop an educational and marketing program about the value of underutilized but highly effective BMPs such as grass filter strips, cover crops, stream fencing, riparian buffers, and livestock loafing lot management.

- Provide funding for educational field days for both farmers and non-farmers, and to develop water quality education programs for adult and youth audiences.

Staffing, Training and Related Funding Needed to Implement the Strategy:

- Provide sufficient funds to employ 5 new SWCD positions within the York basin for technical, clerical and administrative assistance to implement the agricultural portion of the strategy. These additional persons (out of a proposed total of 13 positions) would also help implement the Rappahannock and James River Tributary Strategies.

- Provide $5,000 per year to each SWCDs in the basin to provide support of positions, office space, travel, telephone, supplies and equipment.

- Provide one additional Agricultural Engineer to provide training and leadership to SWCD staff and to provide technical oversight of structural and designed BMPs. Provided there is significant participation by the private sector, the existing DCR Nutrient Management Specialist staff, should be able to meet the demand for nutrient management plans in support of the strategy over the 10 year implementation period.

- Increase training opportunities for SWCD staff responsible for administering the cost share and tax credit programs.

Implementation Cost Estimates

The cost estimate for the implementation of the Final Strategy totals $45,402,000, over a ten-year period through the year 2010. This estimate is broken down into $23,142,000 for nonpoint source Best Management Practices (BMPs), $19,650,000 for Biological Nutrient Removal (BNR) at point source facilities with a flow capacity of 1 million gallons per day or more, and $2,610,000 in administrative costs for state and local governments.

Municipal wastewater facilities can now apply for 50% of the construction costs related to improvements in treatment,through the Water Quality Improvement Fund. Industrial facilities can apply for other costs, such as design costs for improvements, through technical assistance grants. This assistance is awarded through a competitive process and is based on available funding.

Cost share for nonpoint source BMPs will be allocated for agricultural BMPs through the soil and water conservation districts, and to projects, which urban BMPs will also be eligible for.

Implementation Roles and Responsibilities

Most of the management measures which make up the strategy (2010 Scenario) are for agricultural practices. Continued efforts by the soil and water conservation districts in the watershed to encourage farmers to implement these best management practices (BMPs), through participation in the Virginia Agricultural BMP Cost Share Program, is vital for the success of nutrient reduction efforts.

Presently, the land cover of the York and Lower Coastal watersheds is still predominately rural. However, urbanization is increasing. Stormwater management will become increasingly important for local governments in the region. The strategy (Table 1) includes management measures for several urban BMPs: stormwater quality retrofits; urban nutrient management for golf courses, businesses, and residences; nontidal stream restoration; erosion and sediment control; (tidal) shoreline protection; marina pumpouts; septic tank pumpouts; and septic tank connections to public sewer. Projects to install such BMPs can be pursued by local governments, regional planning district commissions, and/or soil and water conservation districts, though the Water Quality Improvement Fund.

Conservation Reserve Enhancement Program (CREP)

The Conservation Reserve Enhancement Program (CREP) is a new program that will compensate property owners on eligible agricultural land, to establish vegetative riparian buffers, restore wetlands, and set aside permanent conservation easements. CREP is a federal, state, local, private partnership, that will make more than $90,000,000 available in Virginia over the next five years (2000-2005).

CREP will be administered in Virginia through the Farm Service Agency, in the United States Department of Agricuture, with assistance from the local soil and water conservation districts. If effectively marketed throughout the watershed, CREP will play a major role in the implementation of the strategy.

V. EVALUATION OF STRATEGY IMPLEMENTATION

Programmatic and Environmental Benchmarks and Indicators for Evaluating Strategy Progress

Progress toward meeting the goals of this strategy will be assessed on an ongoing basis and reported in an annual report submitted to the Virginia General Assembly. Progress will be assessed for both programmatic and environmental indicators. Programmatic indicators are gauges of implementation activities and benchmarks for these indicators will be the period prior to strategy development. The environmental indicators will measure the success of environmental restoration and benchmarks will generally be the conditions in the mid 1980's when comprehensive, long-term environmental monitoring was initiated.

a. Programmatic Benchmarks and Indicators

The following table contains the programmatic indicators and associated benchmarks.

Programmatic Indicator	Benchmark
Money spent on PS nutrient reduction capital improvements	1996
Money spent on NPS implementation	1996
Acres under NPS BMPs	1996
% of POTW discharge that undergoes BNR	1996

b. Environmental Benchmarks and Indicators

Environmental indicators of progress are the true measure of success of this strategy. The following table generally defines the individual indicators and associated benchmarks that have been used in the development of this strategy and will be used for tracking its progress. These indicators and benchmarks will probably evolve and expand as new or better ones are developed.

Environmental Indicator	Benchmark(s)
Nutrient loading discharged from PS throughout Bay watershed	1985 level
Nutrient loading entering from NPS throughout Bay Watershed	1985 level
Environmental Indicator	**Benchmark(s)**
Nutrient loading entering Chesapeake Bay tidal tributaries via major tributaries (i.e. fall line nutrient loads)	1985 level

Nutrient levels throughout Chesapeake Bay and its watershed	1985 level
Dissolved oxygen levels in Chesapeake Bay and major tidal waters	D.O. goals, 1985 level
Water Clarity in Chesapeake Bay and major tidal waters	SAV requirements
SAV coverage in Chesapeake Bay and major tidal waters	Potential habitat, Tier I
Plankton community health in Chesapeake Bay and major tidal waters	Indexes of Biotic Integrity
Benthic community health in Chesapeake Bay and major tidal waters	Indexes of Biotic Integrity

Monitoring information from efforts carried out by the Federal-Interstate Chesapeake Bay Monitoring Program will be the main source of data for these environmental indicators. Applicable data will also be obtained from other sources such as: monitoring programs within State agencies such as VADEQ, DCR, and CBLAD; educational institutions such as VIMS, ODU, and Virginia Tech; and volunteer monitoring programs such as those conducted by the Alliance for Chesapeake Bay and Save our Streams (Isaac Walton league). The Chesapeake Bay monitoring program was designed and implemented in 1985 to provide general monitoring of water quality, plankton, and benthos over relatively large spatial and temporal scales. Tracking the progress for this tributary specific sediment/nutrient reduction strategy may require enhancement of this and other monitoring programs. An assessment of the need for any enhancements will be performed and findings presented in the annual report the Secretary of natural resources submits to the Virginia General Assembly on the status of Virginia's Tributary Strategy Program.

Analysis of Monitoring Data Needed

Additional analysis of existing monitoring data in the York watershed is needed. Existing data suggests that the York has a benthic community that is both severely impacted yet has a greater potential for improvement, of any of the Lower Tributaries of the Chesapeake Bay. This analysis should enable more targeted monitoring in the future and provide valuable insight into how the biological community may respond to the various management measures proposed in the Final Strategy. Efforts should specifically focus on sediments and low dissolved oxygen levels in the watershed.

Additional technical studies have been recommended by stakeholders and will be considered further by the Tributary Team. These include: the relationship between nutrient loadings and the production of dinoflagellate blooms; the relationships between water quality variables including chlorophyll *a*, plankton composition, and the influence of plankton composition on upper trophic levels; the characteristics, sources, and dynamics of suspended solids, and the degree to which they are resuspended and controllable in the York River system; the influence of historical filter feeder populations (oysters and menhaden) on water quality and their relationship to the Chesapeake Bay Program Water Quality Model; and, an improved understanding of site-specific causes of light attenuation from suspended solids, chlorophyll, and epiphytic material. Any new water monitoring data obtained will be discussed during the re-evaluation of the strategy.

Program Re-evaluation and Total Maximum Daily Loads (TMDLs)

A program re-evaluation was originally scheduled for the year 2004. This re-evaluation will now be in two stages, the first in 2002, the second in 2004.

The first stage of the re-evaluation, in 2002, will be conducted pursuant to the effort to de-list the York River, and the tidal portions of its major tributaries, the Mattaponi and Pamunky Rivers, from the impaired waters (303d) list by 2010. This stage of the re-evaluation will address new goals, called environmental endpoints, which will be developed in cooperation with the Chesapeake Bay Program, in accordance with the Year 2000 Chesapeake Bay Agreement. A draft of this agreement was released for public comment in December 1999 and will be signed by Virginia and several other states when finalized. These endpoints will determine the water quality conditions necessary to protect aquatic life and assign the nitrogen, phosphorus, and sediment reductions necessary to meet these conditions. After environmental endpoints are determined (2001), the York Strategy will be re-evaluated and revised as necessary by the following year (2002) to achieve them by 2010. The agreement will also require states who sign it to revise their water quality standards (2003), as needed, to make them consistent with the water quality levels the environmental endpoints call for.

The purpose of the second stage of the re-evaluation, in 2004, will be to: discuss progress towards and obstacles to implementation of the management measures (as revised in the first stage of the re-evaluation), review and interpret updated model runs, that will be requested, using more recent land use projections and increases in point source flows since the strategy was written, and to reinvest the stakeholders in their commitment to achieve the nutrient and sediment reduction goals.

The successful implementation of the tributary strategies, including the York's, would mean that TMDLs (Total Maximum Daily Loads) would not be required for Virginia's tidal tributaries (by 2011). If TMDLs were to be required, the applicable watersheds would then fall under a pervasive regulatory program, which would affect Virginia's citizens in all walks of life. Virginia remains committed to voluntary measures. Regulatory programs often fail to engender personal responsibility and commitment to protecting water quality; and such committment is the only approach that will make restoration of Virginia's waters successful in the long run.

Nonpoint Source BMPs for Albemarle County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

BMP Treatment	units	Year 1996 Progress Coverage	Percent	Reductions (lbs or tons per year) Nitrogen	Phosphorus	Sediment
Farm Plans	acres	1,374		1,077	65	56
Nutrient Management	acres	29		28	1	0
Agricultural Land Retirement	acres	63		329	46	45
Grazing Land Protection	acres	55		145	3	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	0		0	0	0
Grass Filter Strips	acres	0		0	0	0
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	22		96	2	5
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	0		0	0	0
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	0		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	1,675	117	106
			Adjustment for Land Use Changes:	(184)	(29)	8
			Adjusted Reduction:	1,859	146	97
			Nonpoint Controllable Amount:	16,772	1,216	864
			Percent Reduction:	11.1%	12.0%	11.3%

Nonpoint Source BMPs for Fluvanna County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	124		94	6	5
Nutrient Management	acres	2		2	0	0
Agricultural Land Retirement	acres	0		1	0	0
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	0		0	0	0
Grass Filter Strips	acres	0		0	0	0
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	4		19	0	1
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	0		0	0	0
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	0		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
		Total Pounds Reduced:		116	7	6
		Adjustment for Land Use Changes:		53	(2)	(1)
		Adjusted Reduction:		63	9	8
		Nonpoint Controllable Amount:		1,459	109	74
		Percent Reduction:		4.3%	8.4%	10.2%

Nonpoint Source BMPs for Goochland County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	749		628	134	116
Nutrient Management	acres	42		44	2	0
Agricultural Land Retirement	acres	3		25	3	2
Grazing Land Protection	acres	1		3	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	446		1,981	94	80
Grass Filter Strips	acres	0		0	0	0
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	49		220	4	11
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	0		0	0	0
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	0		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	2,900	237	210
			Adjustment for Land Use Changes:	2,266	(48)	(39)
			Adjusted Reduction:	634	286	249
			Nonpoint Controllable Amount:	19,504	1,608	1,132
			Percent Reduction:	3.3%	17.8%	22.0%

Nonpoint Source BMPs for Louisa County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	36,196		18,671	2,374	2,010
Nutrient Management	acres	1,383		769	48	0
Agricultural Land Retirement	acres	398		2,320	332	272
Grazing Land Protection	acres	919		2,114	49	0
Stream Protection	acres	27		15	3	3
Cover Crops	acres	0		0	0	0
Grass Filter Strips	acres	41		420	52	43
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	2,260		7,559	254	532
Animal Waste Control Facilities	systems	2		2,183	109	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	372		6,748	267	340
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	0		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	40,799	3,486	3,200
			Adjustment for Land Use Changes:	20,560	(1,030)	(857)
			Adjusted Reduction:	20,239	4,516	4,057
			Nonpoint Controllable Amount:	361,430	36,429	25,944
			Percent Reduction:	5.6%	12.4%	15.6%

Nonpoint Source BMPs for Orange County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	19,385		2,861	1,286	1,090
Nutrient Management	acres	2,977		441	87	0
Agricultural Land Retirement	acres	112		249	92	75
Grazing Land Protection	acres	333		192	17	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	0		0	0	0
Grass Filter Strips	acres	0		0	0	0
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	412		330	66	100
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	1		27	10	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	39		289	25	38
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	0		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	4,390	1,582	1,302
			Adjustment for Land Use Changes:	(7,660)	(4,263)	(3,357)
			Adjusted Reduction:	12,049	5,845	4,660
			Nonpoint Controllable Amount:	58,035	22,187	16,580
			Percent Reduction:	20.8%	26.3%	28.1%

Nonpoint Source BMPs for Spotsylvania County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	24,810		6,330	2,133	1,086
Nutrient Management	acres	3,483		3,279	190	0
Agricultural Land Retirement	acres	722		2,319	491	242
Grazing Land Protection	acres	175		92	2	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	70		121	13	7
Grass Filter Strips	acres	0		0	0	0
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	1,428		3,296	102	161
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	498		10,130	448	109
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	0		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	25,567	3,379	1,605
			Adjustment for Land Use Changes:	26,089	(525)	(740)
			Adjusted Reduction:	(521)	3,904	2,345
			Nonpoint Controllable Amount:	162,062	23,275	9,293
			Percent Reduction:	-0.3%	16.8%	25.2%

Nonpoint Source BMPs for Upper York Region (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	82,637		29,661	5,998	4,364
Nutrient Management	acres	7,916		4,562	328	0
Agricultural Land Retirement	acres	1,298		5,243	964	635
Grazing Land Protection	acres	1,484		2,546	70	0
Stream Protection	acres	27		15	3	3
Cover Crops	acres	515		2,101	107	86
Grass Filter Strips	acres	41		420	52	43
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	4,175		11,520	428	811
Animal Waste Control Facilities	systems	2		2,183	109	0
Poultry Waste Control Facilities	systems	1		27	10	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	909		17,168	740	487
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	0		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
		Total Pounds Reduced:		75,446	8,808	6,429
		Adjustment for Land Use Changes:		41,123	(5,899)	(4,987)
		Adjusted Reduction:		34,323	14,707	11,416
		Nonpoint Controllable Amount:		619,261	84,824	53,888
		Percent Reduction:		5.5%	17.3%	21.2%

Nonpoint Source BMPs for Caroline County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	35,037		17,484	8,209	2,754
Nutrient Management	acres	10,130		13,128	963	0
Agricultural Land Retirement	acres	950		3,821	817	232
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	1,441		4,017	265	64
Grass Filter Strips	acres	0		0	0	0
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	1,907		5,440	66	143
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	293		9,634	357	73
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
		Total Pounds Reduced:		53,524	10,678	3,266
		Adjustment for Land Use Changes:		57,057	1,881	2,301
		Adjusted Reduction:		(3,533)	8,797	965
		Nonpoint Controllable Amount:		314,679	42,800	8,753
		Percent Reduction:		-1.1%	20.6%	11.0%

Nonpoint Source BMPs for Hanover County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	49,843		56,925	12,356	7,933
Nutrient Management	acres	5,707		12,999	850	0
Agricultural Land Retirement	acres	541		4,406	471	307
Grazing Land Protection	acres	72		225	3	0
Stream Protection	acres	64		192	6	5
Cover Crops	acres	1,364		8,035	281	118
Grass Filter Strips	acres	48		1,172	92	20
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	1,592		7,114	133	304
Animal Waste Control Facilities	systems	1		1,091	54	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	204		16,503	658	166
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	108,661	14,906	8,852
			Adjustment for Land Use Changes:	88,866	4,392	3,041
			Adjusted Reduction:	19,795	10,513	5,811
			Nonpoint Controllable Amount:	959,220	67,424	32,174
			Percent Reduction:	2.1%	15.6%	18.1%

Nonpoint Source BMPs for Central York Region (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	84,880		74,409	20,565	10,687
Nutrient Management	acres	15,837		26,127	1,813	0
Agricultural Land Retirement	acres	1,491		8,226	1,288	539
Grazing Land Protection	acres	72		225	3	0
Stream Protection	acres	64		192	6	5
Cover Crops	acres	2,805		12,052	546	182
Grass Filter Strips	acres	48		1,172	92	20
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	3,499		12,554	199	446
Animal Waste Control Facilities	systems	1		1,091	54	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	496		26,137	1,015	239
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	162,186	25,584	12,118
			Adjustment for Land Use Changes:	145,923	6,273	5,342
			Adjusted Reduction:	16,263	19,310	6,776
			Nonpoint Controllable Amount:	1,273,899	110,224	40,927
			Percent Reduction:	1.3%	17.5%	16.6%

Nonpoint Source BMPs for Essex County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	166		153	31	8
Nutrient Management	acres	454		1,954	111	0
Agricultural Land Retirement	acres	15		162	15	3
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	40		257	8	2
Grass Filter Strips	acres	5		122	10	2
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	8		32	0	1
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	0		0	0	0
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	2,681	176	15
			Adjustment for Land Use Changes:	2,291	131	1
			Adjusted Reduction:	390	45	15
			Nonpoint Controllable Amount:	4,627	347	47
			Percent Reduction:	8.4%	13.0%	31.1%

Nonpoint Source BMPs for Essex County (Coastal Basins)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	4,266		4,818	997	444
Nutrient Management	acres	1,265		7,119	(92)	0
Agricultural Land Retirement	acres	230		3,823	312	123
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	0		0	0	0
Grass Filter Strips	acres	14		398	36	15
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	107		542	7	22
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	8		448	15	6
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	17,147	1,275	610
			Adjustment for Land Use Changes:	(16,054)	(451)	(274)
			Adjusted Reduction:	33,200	1,726	883
			Nonpoint Controllable Amount:	95,690	7,033	2,653
			Percent Reduction:	34.7%	24.5%	33.3%

Nonpoint Source BMPs for Essex County (York River & Coastal Basins)

Based on Implementation of Current Programs (via State Program Tracking Information)

BMP Treatment	units	Year 1996 Progress Coverage	Percent	Reductions (lbs or tons per year) Nitrogen	Phosphorus	Sediment
Farm Plans	acres	4,432		4,971	1,028	451
Nutrient Management	acres	1,719		9,073	19	0
Agricultural Land Retirement	acres	245		3,984	327	126
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	40		257	8	2
Grass Filter Strips	acres	19		520	46	17
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	115		574	8	23
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	8		448	15	6
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	19,828	1,451	625
			Adjustment for Land Use Changes:	(13,763)	(320)	(273)
			Adjusted Reduction:	33,590	1,771	898
			Nonpoint Controllable Amount:	100,317	7,380	2,700
			Percent Reduction:	33.5%	24.0%	33.3%

Nonpoint Source BMPs for Gloucester County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	10,056		14,742	3,323	887
Nutrient Management	acres	1,069		4,995	314	0
Agricultural Land Retirement	acres	71		1,167	78	16
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	215		1,391	44	11
Grass Filter Strips	acres	0		0	0	0
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	337		1,511	24	35
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	226		21,390	880	181
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
			Total Pounds Reduced:	45,196	4,662	1,131
			Adjustment for Land Use Changes:	34,241	1,464	240
			Adjusted Reduction:	10,955	3,198	891
			Nonpoint Controllable Amount:	260,463	14,610	2,998
			Percent Reduction:	4.2%	21.9%	29.7%

Nonpoint Source BMPs for Gloucester County (Coastal Basins)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	13,085		20,742	5,183	2,447
Nutrient Management	acres	2,072		9,999	(296)	0
Agricultural Land Retirement	acres	173		2,943	238	94
Grazing Land Protection	acres	38		120	1	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	59		420	15	7
Grass Filter Strips	acres	28		825	75	31
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	692		3,511	48	145
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	90		5,341	176	72
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
			Total Pounds Reduced:	43,901	5,440	2,796
			Adjustment for Land Use Changes:	(35,850)	(782)	(90)
			Adjusted Reduction:	79,751	6,222	2,886
			Nonpoint Controllable Amount:	329,967	21,767	8,192
			Percent Reduction:	24.2%	28.6%	35.2%

Nonpoint Source BMPs for Gloucester County (York River & Coastal Basins)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	23,141		35,484	8,505	3,334
Nutrient Management	acres	3,141		14,994	18	0
Agricultural Land Retirement	acres	245		4,110	315	110
Grazing Land Protection	acres	38		120	1	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	275		1,811	59	17
Grass Filter Strips	acres	28		825	75	31
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	1,029		5,022	72	181
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	316		26,730	1,056	253
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
			Total Pounds Reduced:	89,097	10,102	3,927
			Adjustment for Land Use Changes:	(1,609)	681	150
			Adjusted Reduction:	90,706	9,420	3,777
			Nonpoint Controllable Amount:	590,430	36,377	11,190
			Percent Reduction:	15.4%	25.9%	33.8%

Nonpoint Source BMPs for James City County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	1,991		2,587	377	100
Nutrient Management	acres	245		918	67	0
Agricultural Land Retirement	acres	19		244	19	4
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	0		0	0	0
Grass Filter Strips	acres	8		195	15	3
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	163		728	11	17
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	162		15,304	630	130
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
		Total Pounds Reduced:		19,976	1,119	254
		Adjustment for Land Use Changes:		22,465	1,011	195
		Adjusted Reduction:		(2,489)	108	60
		Nonpoint Controllable Amount:		78,133	4,471	605
		Percent Reduction:		-3.2%	2.4%	9.9%

Nonpoint Source BMPs for King & Queen County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

BMP Treatment	units	Year 1996 Progress Coverage	Percent	Reductions (lbs or tons per year) Nitrogen	Phosphorus	Sediment
Farm Plans	acres	30,399		32,227	6,423	1,631
Nutrient Management	acres	11,003		47,743	2,731	0
Agricultural Land Retirement	acres	1,070		14,079	1,117	225
Grazing Land Protection	acres	80		101	1	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	507		3,279	103	25
Grass Filter Strips	acres	1		24	2	0
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	1,146		4,938	75	115
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	130		11,757	483	99
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
			Total Pounds Reduced:	114,148	10,935	2,095
			Adjustment for Land Use Changes:	30,881	2,023	(378)
			Adjusted Reduction:	83,267	8,912	2,473
			Nonpoint Controllable Amount:	636,537	43,434	8,566
			Percent Reduction:	13.1%	20.5%	28.9%

Nonpoint Source BMPs for King & Queen County (Coastal Basins)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	4,334		5,158	1,124	505
Nutrient Management	acres	3,645		20,091	(351)	0
Agricultural Land Retirement	acres	283		5,000	392	154
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	0		0	0	0
Grass Filter Strips	acres	4		118	11	4
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	393		1,996	28	83
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	135		8,056	266	108
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
		Total Pounds Reduced:		40,419	1,469	854
		Adjustment for Land Use Changes:		8,068	(260)	7
		Adjusted Reduction:		32,350	1,729	848
		Nonpoint Controllable Amount:		103,910	7,459	2,631
		Percent Reduction:		31.1%	23.2%	32.2%

Nonpoint Source BMPs for King & Queen County (York River & Coastal Basins)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	34,733		37,385	7,547	2,136
Nutrient Management	acres	14,649		67,834	2,380	0
Agricultural Land Retirement	acres	1,353		19,079	1,509	379
Grazing Land Protection	acres	80		101	1	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	507		3,279	103	25
Grass Filter Strips	acres	5		142	13	5
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	1,539		6,934	103	197
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	265		19,813	748	207
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
		Total Pounds Reduced:		154,567	12,404	2,949
		Adjustment for Land Use Changes:		38,949	1,763	(371)
		Adjusted Reduction:		115,617	10,641	3,321
		Nonpoint Controllable Amount:		740,447	50,893	11,197
		Percent Reduction:		15.6%	20.9%	29.7%

Nonpoint Source BMPs for King William County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	47,682		52,555	6,633	1,720
Nutrient Management	acres	12,232		58,317	3,087	0
Agricultural Land Retirement	acres	535		8,223	554	116
Grazing Land Protection	acres	73		312	2	0
Stream Protection	acres	9		35	0	0
Cover Crops	acres	232		1,500	47	11
Grass Filter Strips	acres	79		1,929	152	33
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	1,147		5,084	79	119
Animal Waste Control Facilities	systems	2		3,613	277	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	169		14,655	601	122
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	146,222	11,433	2,122
			Adjustment for Land Use Changes:	(47,774)	(6,576)	(2,261)
			Adjusted Reduction:	193,996	18,009	4,383
			Nonpoint Controllable Amount:	985,918	62,472	13,011
			Percent Reduction:	19.7%	28.8%	33.7%

Nonpoint Source BMPs for Mathews County (Coastal Basins)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	1,723		2,777	685	325
Nutrient Management	acres	743		3,540	(93)	0
Agricultural Land Retirement	acres	113		2,037	157	62
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	45		320	12	5
Grass Filter Strips	acres	0		0	0	0
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	401		2,036	28	84
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	23		1,379	45	19
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
			Total Pounds Reduced:	12,089	834	495
			Adjustment for Land Use Changes:	(45,850)	(3,824)	(1,707)
			Adjusted Reduction:	57,939	4,658	2,202
			Nonpoint Controllable Amount:	230,197	15,283	5,818
			Percent Reduction:	25.2%	30.5%	37.8%

Nonpoint Source BMPs for Middlesex County (Coastal Basins)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	8,210		11,514	2,699	1,256
Nutrient Management	acres	1,221		6,284	(121)	0
Agricultural Land Retirement	acres	52		905	72	28
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	42		294	11	5
Grass Filter Strips	acres	0		0	0	0
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	245		1,244	17	51
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	5		320	11	4
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	0		0	0	0
			Total Pounds Reduced:	20,561	2,688	1,344
			Adjustment for Land Use Changes:	(44,500)	(1,592)	(947)
			Adjusted Reduction:	65,061	4,279	2,291
			Nonpoint Controllable Amount:	197,424	14,031	5,744
			Percent Reduction:	33.0%	30.5%	39.9%

Nonpoint Source BMPs for New Kent County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	6,311		8,206	1,390	368
Nutrient Management	acres	2,409		10,156	664	0
Agricultural Land Retirement	acres	17		198	18	3
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	0		0	0	0
Grass Filter Strips	acres	38		916	72	16
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	472		2,115	33	50
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	49		4,638	191	39
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
		Total Pounds Reduced:		26,229	2,367	476
		Adjustment for Land Use Changes:		13,606	997	224
		Adjusted Reduction:		12,623	1,370	252
		Nonpoint Controllable Amount:		198,327	11,927	1,918
		Percent Reduction:		6.4%	11.5%	13.1%

Nonpoint Source BMPs for York County (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	1,720		2,498	340	94
Nutrient Management	acres	487		1,751	138	0
Agricultural Land Retirement	acres	30		274	30	5
Grazing Land Protection	acres	0		0	0	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	0		0	0	0
Grass Filter Strips	acres	0		0	0	0
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	281		1,259	20	29
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	153		14,481	596	123
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
		Total Pounds Reduced:		20,262	1,124	251
		Adjustment for Land Use Changes:		27,404	1,057	159
		Adjusted Reduction:		(7,142)	67	92
		Nonpoint Controllable Amount:		141,352	8,435	832
		Percent Reduction:		-5.1%	0.8%	11.1%

Nonpoint Source BMPs for Lower York Region (York River Basin)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	98,325		112,969	18,517	4,808
Nutrient Management	acres	27,898		125,834	7,112	0
Agricultural Land Retirement	acres	1,757		24,346	1,831	373
Grazing Land Protection	acres	153		413	3	0
Stream Protection	acres	9		35	0	0
Cover Crops	acres	994		6,427	203	49
Grass Filter Strips	acres	131		3,186	251	55
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	3,554		15,667	242	366
Animal Waste Control Facilities	systems	2		3,613	277	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	889		82,224	3,380	694
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
			Total Pounds Reduced:	374,713	31,815	6,345
			Adjustment for Land Use Changes:	83,114	106	(1,820)
			Adjusted Reduction:	291,599	31,709	8,165
			Nonpoint Controllable Amount:	2,305,357	145,695	27,976
			Percent Reduction:	12.6%	21.8%	29.2%

Nonpoint Source BMPs for Lower York Region (Coastal Basins)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	31,618		45,009	10,688	4,977
Nutrient Management	acres	8,946		47,033	(954)	0
Agricultural Land Retirement	acres	850		14,708	1,170	460
Grazing Land Protection	acres	38		120	1	0
Stream Protection	acres	0		0	0	0
Cover Crops	acres	146		1,034	38	17
Grass Filter Strips	acres	46		1,340	122	50
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	1,838		9,329	129	386
Animal Waste Control Facilities	systems	0		0	0	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	260		15,544	512	209
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
			Total Pounds Reduced:	134,117	11,705	6,099
			Adjustment for Land Use Changes:	(134,185)	(6,909)	(3,010)
			Adjusted Reduction:	268,302	18,614	9,109
			Nonpoint Controllable Amount:	957,187	65,572	25,038
			Percent Reduction:	28.0%	28.4%	36.4%

Nonpoint Source BMPs for Lower York Region (York River & Coastal Basins)

Based on Implementation of Current Programs (via State Program Tracking Information)

		Year 1996 Progress		Reductions (lbs or tons per year)		
BMP Treatment	units	Coverage	Percent	Nitrogen	Phosphorus	Sediment
Farm Plans	acres	129,943		157,977	29,204	9,785
Nutrient Management	acres	36,844		172,867	6,158	0
Agricultural Land Retirement	acres	2,608		39,054	3,001	833
Grazing Land Protection	acres	191		533	3	0
Stream Protection	acres	9		35	0	0
Cover Crops	acres	1,140		7,461	240	66
Grass Filter Strips	acres	176		4,527	373	106
Woodland Buffer Filter Area	acres	0		0	0	0
Forest Harvesting	acres	5,392		24,996	371	752
Animal Waste Control Facilities	systems	2		3,613	277	0
Poultry Waste Control Facilities	systems	0		0	0	0
Loafing Lot Management	systems	0		0	0	0
Erosion & Sediment Control	acres	1,149		97,768	3,892	903
Urban SWM/BMP Retrofits	acres	No data		0	0	0
Urban Nutrient Management	acres	0		0	0	0
Septic Pumping	systems	pending		0	0	0
Shoreline Erosion Protection	linear feet	pending		0	0	0
			Total Pounds Reduced:	508,830	43,521	12,444
			Adjustment for Land Use Changes:	(51,071)	(6,803)	(4,830)
			Adjusted Reduction:	559,901	50,324	17,275
			Nonpoint Controllable Amount:	3,262,544	211,267	53,015
			Percent Reduction:	17.2%	23.8%	32.6%

Albemarle County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	162	4,067	2,286	207	2,079	588	215	4	211
Crops (CS)	117	2,334	1,312	149	1,163	325	119	3	116
Hayland	770	8,267	4,646	982	3,664	1,285	470	20	451
Pasture	2,066	19,416	10,912	2,635	8,277	1,198	438	53	386
Forest	2,157	4,897	2,752	2,752	0	151	55	55	0
All Urban	30	247	139	38	101	16	6	1	5
Open Water	10	105	59	59	0	6	2	2	0
Animal Waste	1	1,706	958	1	958	131	48	0	48
Septic	-----	943	530	0	530	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	5,312	41,982	23,594	6,822	16,772	3,700	1,354	138	1,216

Albemarle County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	59	1,486	835	76	760	215	79	2	77
Crops (CS)	112	2,246	1,262	143	1,119	313	115	3	112
Hayland	984	10,564	5,937	1,255	4,682	1,643	601	25	576
Pasture	1,956	18,383	10,331	2,495	7,837	1,134	415	50	365
Forest	2,154	4,890	2,748	2,748	0	151	55	55	0
All Urban	36	300	168	46	122	20	7	1	6
Open Water	10	105	59	59	0	6	2	2	0
Animal Waste	0	832	467	0	467	64	23	0	23
Septic	-----	1,206	678	0	678	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	5,312	40,011	22,486	6,822	15,664	3,544	1,297	138	1,159

Fluvanna County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	4	105	59	5	54	15	6	0	5
Crops (CS)	16	328	184	21	163	46	17	0	16
Hayland	83	894	503	106	396	139	51	2	49
Pasture	151	1,415	795	192	603	87	32	4	28
Forest	426	967	544	544	(0)	30	11	11	0
All Urban	39	324	182	50	132	21	8	1	7
Open Water	4	36	20	20	0	2	1	1	0
Animal Waste	0	139	78	0	78	11	4	0	4
Septic	-----	56	31	0	31	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	723	4,265	2,397	938	1,459	351	128	19	109

Fluvanna County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	6	141	79	7	72	20	7	0	7
Crops (CS)	14	289	162	18	144	40	15	0	14
Hayland	81	870	489	103	386	135	50	2	47
Pasture	146	1,377	774	187	587	85	31	4	27
Forest	415	941	529	529	0	29	11	11	0
All Urban	58	477	268	73	195	31	11	1	10
Open Water	4	36	20	20	0	2	1	1	0
Animal Waste	0	66	37	0	37	5	2	0	2
Septic	-----	71	40	0	40	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	723	4,268	2,399	938	1,460	348	127	19	108

Goochland County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	394	9,903	5,566	503	5,062	1,432	524	10	514
Crops (CS)	535	10,708	6,018	682	5,336	1,491	546	14	532
Hayland	440	4,725	2,655	561	2,094	735	269	11	258
Pasture	572	5,379	3,023	730	2,293	332	121	15	107
Forest	5,115	11,611	6,525	6,525	0	358	131	131	(0)
All Urban	974	8,072	4,536	1,242	3,294	526	192	25	167
Open Water	31	316	177	177	0	18	6	6	0
Animal Waste	0	1,063	598	1	597	81	30	0	30
Septic	-----	1,473	828	0	828	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	8,061	53,249	29,926	10,422	19,504	4,973	1,820	212	1,608

Goochland County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	500	12,556	7,056	638	6,418	1,815	664	13	651
Crops (CS)	396	7,931	4,457	505	3,952	1,105	404	10	394
Hayland	424	4,557	2,561	541	2,020	709	259	11	248
Pasture	552	5,190	2,917	704	2,212	320	117	14	103
Forest	4,933	11,199	6,294	6,294	0	345	126	126	(0)
All Urban	1,225	10,157	5,708	1,563	4,145	662	242	31	211
Open Water	31	316	177	177	0	18	6	6	0
Animal Waste	0	501	281	0	281	38	14	0	14
Septic	-----	1,883	1,058	0	1,058	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	8,062	54,289	30,510	10,423	20,087	5,012	1,834	212	1,622

Louisa County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	6,211	164,028	69,345	6,219	63,126	22,875	8,372	193	8,179
Crops (CS)	8,574	181,934	76,471	8,585	67,886	24,504	8,968	267	8,701
Hayland	19,911	210,336	93,933	19,936	73,997	33,701	12,334	620	11,714
Pasture	23,537	221,192	97,473	23,568	73,905	13,533	4,953	733	4,220
Forest	228,928	523,694	218,768	218,768	(0)	20,053	7,339	7,339	0
All Urban	17,338	140,110	59,456	16,384	43,072	8,785	3,215	560	2,656
Open Water	9,707	98,262	16,200	16,200	0	5,533	2,025	2,025	0
Animal Waste	14	34,203	14,235	13	14,221	2,622	960	0	959
Septic	-----	57,794	25,222	0	25,222	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	314,221	1,631,552	671,103	309,673	361,430	131,606	48,166	11,738	36,429

Louisa County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	1,954	51,604	21,823	1,957	19,866	7,197	2,634	61	2,573
Crops (CS)	12,640	268,204	112,753	12,659	100,094	36,124	13,221	394	12,827
Hayland	19,653	207,621	92,739	19,682	73,057	33,265	12,175	612	11,563
Pasture	23,240	218,400	96,262	23,275	72,987	13,363	4,891	724	4,167
Forest	225,960	516,902	215,984	215,984	0	19,790	7,243	7,243	0
All Urban	21,064	170,222	72,243	19,907	52,336	10,673	3,906	680	3,226
Open Water	9,707	98,262	16,200	16,200	0	5,533	2,025	2,025	0
Animal Waste	7	16,654	6,876	6	6,869	1,277	467	0	467
Septic	-----	73,804	32,237	0	32,237	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	314,227	1,621,673	667,117	309,672	357,445	127,221	46,562	11,738	34,824

Orange County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	6,904	204,363	21,936	1,772	20,164	26,032	9,596	314	9,282
Crops (CS)	2,272	54,949	5,869	583	5,285	6,813	2,511	103	2,408
Hayland	10,032	99,366	11,090	2,576	8,514	17,326	6,383	456	5,926
Pasture	21,875	201,260	21,875	5,617	16,258	12,004	4,402	995	3,407
Forest	41,568	94,889	9,549	9,549	0	5,147	1,893	1,893	0
All Urban	2,815	21,765	3,891	1,110	2,781	1,270	465	122	343
Open Water	374	3,779	389	389	0	213	78	78	0
Animal Waste	12	28,674	3,209	3	3,206	2,200	821	1	821
Septic	-----	16,508	1,827	0	1,827	0	0	0	0
Point Source	-----	31,309	2,163	0	2,163	10,715	3,629	0	3,629
Totals	85,851	756,862	81,796	21,598	60,198	81,720	29,779	3,962	25,816

Orange County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	2,029	60,080	6,410	517	5,892	7,651	2,821	92	2,728
Crops (CS)	3,096	74,877	7,948	789	7,159	9,282	3,421	141	3,280
Hayland	13,015	128,869	14,270	3,318	10,951	22,475	8,280	592	7,688
Pasture	22,568	207,598	22,390	5,754	16,636	12,381	4,540	1,027	3,513
Forest	41,230	94,105	9,443	9,443	0	5,106	1,878	1,878	0
All Urban	3,536	27,341	4,865	1,388	3,477	1,595	584	153	430
Open Water	374	3,779	389	389	0	213	78	78	0
Animal Waste	6	14,258	1,550	1	1,548	1,094	407	0	407
Septic	-----	21,141	2,388	0	2,388	0	0	0	0
Point Source	-----	43,039	2,973	0	2,973	5,754	1,949	0	1,949
Totals	85,853	675,088	72,624	21,600	51,024	65,551	23,958	3,963	19,996

Spotsylvania County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	9,201	177,723	63,809	5,579	58,230	20,976	10,148	201	9,947
Crops (CS)	4,056	63,762	22,848	2,460	20,388	7,298	3,533	89	3,445
Hayland	12,167	67,416	22,912	7,378	15,534	12,395	5,948	266	5,682
Pasture	15,388	67,706	20,885	9,331	11,554	3,536	1,454	337	1,117
Forest	147,202	236,252	97,557	97,557	0	6,808	3,009	3,009	0
All Urban	9,363	64,722	31,553	7,197	24,356	3,910	2,050	174	1,876
Open Water	4,679	47,273	7,444	7,444	0	2,667	1,102	1,102	0
Animal Waste	12	28,779	11,867	7	11,860	2,203	1,209	0	1,209
Septic	-----	43,689	20,140	0	20,140	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	202,067	797,321	299,015	136,953	162,062	59,794	28,454	5,179	23,275

Spotsylvania County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	4,983	96,351	34,372	3,006	31,367	11,373	5,499	109	5,390
Crops (CS)	7,909	124,520	44,315	4,771	39,543	14,259	6,898	174	6,724
Hayland	11,832	65,649	22,133	7,138	14,995	12,074	5,791	260	5,531
Pasture	14,971	66,012	20,163	9,031	11,131	3,447	1,416	329	1,088
Forest	142,817	229,193	94,159	94,159	0	6,628	2,928	2,928	0
All Urban	14,859	102,669	49,999	11,396	38,602	6,201	3,253	277	2,977
Open Water	4,679	47,273	7,444	7,444	0	2,667	1,102	1,102	0
Animal Waste	5	12,134	4,774	3	4,772	929	497	0	497
Septic	-----	64,702	30,228	0	30,228	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	202,056	808,501	307,587	136,948	170,639	57,576	27,384	5,178	22,206

Upper York Region (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	22,877	560,190	163,001	14,285	148,716	71,918	28,861	723	28,138
Crops (CS)	15,570	314,015	112,702	12,480	100,222	40,477	15,694	476	15,218
Hayland	43,403	391,004	135,738	31,539	104,199	65,581	25,455	1,376	24,080
Pasture	63,588	516,367	154,962	42,073	112,889	30,691	11,401	2,136	9,265
Forest	425,396	872,310	335,695	335,695	(0)	32,547	12,439	12,439	0
All Urban	30,559	235,240	99,758	26,021	73,737	14,528	5,936	883	5,053
Open Water	14,805	149,771	24,289	24,289	0	8,439	3,214	3,214	0
Animal Waste	39	94,564	30,945	25	30,920	7,248	3,072	1	3,070
Septic	-----	120,463	48,578	0	48,578	0	0	0	0
Point Source	-----	31,309	2,163	0	2,163	10,715	3,629	0	3,629
Totals	616,236	3,285,232	1,107,831	486,407	621,424	282,143	109,702	21,248	88,454

Upper York Region (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	9,531	222,218	70,576	6,201	64,375	28,271	11,704	277	11,427
Crops (CS)	24,168	478,066	170,897	18,886	152,011	61,122	24,073	722	23,352
Hayland	45,989	418,130	138,128	32,038	106,091	70,301	27,156	1,502	25,654
Pasture	63,433	516,960	152,837	41,447	111,390	30,730	11,411	2,148	9,263
Forest	417,510	857,230	329,157	329,157	0	32,049	12,241	12,241	0
All Urban	40,779	311,165	133,252	34,375	98,877	19,181	8,004	1,144	6,861
Open Water	14,805	149,771	24,289	24,289	0	8,439	3,214	3,214	0
Animal Waste	18	44,445	13,986	11	13,974	3,407	1,411	1	1,410
Septic	-----	162,806	66,628	0	66,628	0	0	0	0
Point Source	-----	43,039	2,973	0	2,973	5,754	1,949	0	1,949
Totals	616,233	3,203,830	1,102,723	486,403	616,320	259,252	101,163	21,248	79,915

Caroline County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	3,027	36,581	21,542	2,493	19,049	5,627	3,236	30	3,207
Crops (CS)	32,170	321,060	190,352	26,497	163,855	51,759	30,126	317	29,810
Hayland	7,403	44,424	26,538	6,097	20,440	7,798	4,600	73	4,527
Pasture	7,000	31,885	19,121	5,765	13,355	789	371	69	302
Forest	192,908	271,444	157,219	157,219	0	3,665	1,919	1,919	0
All Urban	18,747	127,684	73,850	15,234	58,616	7,436	4,425	196	4,229
Open Water	4,090	41,519	23,929	23,929	0	2,332	1,441	1,441	0
Animal Waste	7	15,998	9,255	6	9,249	1,225	725	0	725
Septic	-----	51,532	30,113	0	30,113	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	265,352	942,126	551,919	237,240	314,679	80,630	46,844	4,044	42,800

Caroline County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	24,008	290,062	170,866	19,775	151,090	44,623	25,671	236	25,435
Crops (CS)	10,796	107,711	63,881	8,893	54,989	17,368	10,111	106	10,005
Hayland	7,320	43,935	26,252	6,030	20,223	7,711	4,550	72	4,478
Pasture	6,927	31,557	18,929	5,706	13,223	780	367	68	299
Forest	190,715	268,322	155,440	155,440	0	3,620	1,896	1,896	0
All Urban	21,494	146,397	84,681	17,466	67,215	8,526	5,074	224	4,850
Open Water	4,090	41,519	23,929	23,929	0	2,332	1,441	1,441	0
Animal Waste	1	3,487	2,023	1	2,022	267	144	0	144
Septic	-----	61,463	35,873	0	35,873	0	0	0	0
Point Source	-----	8,733	3,655	0	3,655	1,168	3,655	0	3,655
Totals	265,353	1,003,185	585,530	237,240	348,290	86,394	52,910	4,044	48,866

Hanover County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	13,035	293,857	208,699	16,651	192,047	34,722	16,901	304	16,597
Crops (CS)	26,426	509,243	371,538	33,758	337,780	54,736	26,972	617	26,355
Hayland	16,001	170,130	117,916	20,433	97,483	22,996	11,244	382	10,862
Pasture	21,019	192,115	132,670	26,842	105,827	9,098	3,789	502	3,287
Forest	162,712	319,264	207,794	207,794	0	8,860	3,884	3,884	0
All Urban	15,944	177,845	147,593	20,372	127,221	11,883	9,030	366	8,665
Open Water	3,947	39,220	27,579	27,579	0	2,250	1,306	1,306	0
Animal Waste	16	38,655	26,905	21	26,885	2,962	1,659	0	1,659
Septic	-----	90,396	71,976	0	71,976	0	0	0	0
Point Source	-----	51,562	27,753	0	27,753	14,856	5,032	0	5,032
Totals	259,099	1,882,287	1,340,424	353,451	986,973	162,362	79,818	7,362	72,456

Hanover County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	32,001	722,132	511,859	40,880	470,979	85,504	41,503	747	40,755
Crops (CS)	6,544	126,154	91,853	8,360	83,493	13,595	6,679	153	6,527
Hayland	15,652	166,439	115,139	19,988	95,151	22,531	10,985	374	10,610
Pasture	20,567	188,037	129,610	26,265	103,345	8,932	3,714	491	3,223
Forest	159,155	312,767	203,249	203,249	0	8,691	3,802	3,802	0
All Urban	21,286	237,239	196,731	27,198	169,532	15,850	12,031	488	11,542
Open Water	3,947	39,220	27,579	27,579	0	2,250	1,306	1,306	0
Animal Waste	8	18,245	12,608	10	12,598	1,398	773	0	773
Septic	-----	118,764	95,218	0	95,218	0	0	0	0
Point Souce	-----	275,528	148,303	0	148,303	32,992	11,174	0	11,174
Totals	259,160	2,204,523	1,532,148	353,529	1,178,619	191,743	91,967	7,363	84,605

Central York Region (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	16,061	330,438	230,241	19,144	211,097	40,349	20,138	334	19,804
Crops (CS)	58,596	830,303	561,890	60,255	501,635	106,495	57,098	933	56,164
Hayland	23,403	214,554	144,454	26,531	117,923	30,794	15,844	455	15,389
Pasture	28,019	223,999	151,791	32,608	119,183	9,887	4,160	570	3,590
Forest	355,620	590,708	365,013	365,013	0	12,525	5,803	5,803	0
All Urban	34,691	305,529	221,444	35,606	185,838	19,319	13,456	562	12,894
Open Water	8,038	80,739	51,508	51,508	0	4,581	2,747	2,747	0
Animal Waste	23	54,654	36,160	27	36,134	4,187	2,384	0	2,384
Septic	-----	141,928	102,090	0	102,090	0	0	0	0
Point Source	-----	51,562	27,753	0	27,753	14,856	5,032	0	5,032
Totals	524,451	2,824,413	1,892,343	590,691	1,301,652	242,993	126,661	11,406	115,256

Central York Region (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	56,009	1,012,194	682,725	60,655	622,069	130,127	67,174	984	66,190
Crops (CS)	17,340	233,865	155,734	17,253	138,481	30,963	16,791	259	16,532
Hayland	22,972	210,373	141,391	26,017	115,374	30,242	15,535	446	15,088
Pasture	27,494	219,593	148,539	31,971	116,569	9,712	4,081	559	3,522
Forest	349,870	581,088	358,689	358,689	0	12,311	5,698	5,698	0
All Urban	42,780	383,636	281,412	44,665	236,747	24,376	17,105	713	16,392
Open Water	8,038	80,739	51,508	51,508	0	4,581	2,747	2,747	0
Animal Waste	9	21,731	14,631	11	14,620	1,665	917	0	917
Septic	-----	180,227	131,091	0	131,091	0	0	0	0
Point Source	-----	284,261	151,958	0	151,958	34,160	14,830	0	14,830
Totals	524,513	3,207,708	2,117,679	590,769	1,526,909	278,137	144,878	11,407	133,471

Essex County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	112	1,873	1,781	131	1,650	149	135	2	133
Crops (CS)	66	1,048	1,003	77	926	74	66	1	65
Hayland	13	124	118	16	102	12	11	0	11
Pasture	14	106	101	16	85	1	1	0	1
Forest	850	1,091	932	932	0	14	13	13	0
All Urban	377	2,943	2,100	317	1,783	175	134	3	131
Open Water	0	2	2	2	0	0	0	0	0
Animal Waste	0	79	75	0	75	6	6	0	6
Septic	-----	7	6	0	6	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	1,432	7,273	6,117	1,490	4,627	432	367	20	347

Essex County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	56	943	898	66	832	75	68	1	67
Crops (CS)	119	1,905	1,825	140	1,686	134	120	2	118
Hayland	13	123	117	15	101	12	11	0	11
Pasture	14	105	100	16	84	1	1	0	1
Forest	835	1,072	919	919	(0)	14	13	13	0
All Urban	393	3,084	2,207	332	1,875	184	141	3	138
Open Water	0	2	2	2	0	0	0	0	0
Animal Waste	0	32	32	0	32	2	2	0	2
Septic	-----	8	7	0	7	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	1,432	7,275	6,108	1,490	4,619	422	357	20	337

Essex County (Coastal Basins) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	2,847	60,363	60,363	4,129	56,235	4,243	4,243	57	4,186
Crops (CS)	1,677	30,405	30,405	2,432	27,974	2,163	2,163	34	2,130
Hayland	339	3,592	3,592	491	3,101	441	441	7	434
Pasture	356	2,247	2,247	516	1,732	32	32	7	25
Forest	10,684	15,491	15,491	15,491	0	214	214	214	0
All Urban	292	2,632	2,632	424	2,209	143	143	6	137
Open Water	112	1,066	1,066	1,066	0	64	64	64	0
Animal Waste	1	1,582	1,582	1	1,581	122	122	0	122
Septic	-----	2,859	2,859	0	2,859	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	16,308	120,239	120,239	24,549	95,690	7,421	7,421	388	7,033

Essex County (Coastal Basins) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	1,447	30,666	30,666	2,097	28,569	2,155	2,155	29	2,126
Crops (CS)	3,073	55,710	55,710	4,456	51,254	3,964	3,964	61	3,902
Hayland	339	3,588	3,588	491	3,098	440	440	7	433
Pasture	356	2,249	2,249	516	1,733	32	32	7	25
Forest	10,672	15,474	15,474	15,474	0	213	213	213	0
All Urban	312	2,807	2,807	452	2,355	153	153	6	146
Open Water	112	1,066	1,066	1,066	0	64	64	64	0
Animal Waste	0	0	0	0	0	0	0	0	0
Septic	-----	3,794	3,794	0	3,794	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	16,309	115,354	115,354	24,551	90,803	7,021	7,021	388	6,633

Essex County (Chesapeake Bay Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	2,959	62,237	62,144	4,259	57,885	4,392	4,377	59	4,318
Crops (CS)	1,743	31,454	31,409	2,509	28,900	2,237	2,230	35	2,195
Hayland	352	3,717	3,710	507	3,203	453	452	7	445
Pasture	370	2,353	2,348	532	1,816	33	33	7	26
Forest	11,534	16,582	16,423	16,423	0	228	227	227	0
All Urban	669	5,575	4,732	740	3,992	318	277	9	268
Open Water	112	1,067	1,067	1,067	0	64	64	64	0
Animal Waste	1	1,661	1,657	1	1,656	128	127	0	127
Septic	-----	2,866	2,865	0	2,865	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	17,740	127,511	126,356	26,039	100,317	7,853	7,788	408	7,380

Essex County (Chesapeake Bay Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	1,503	31,610	31,564	2,163	29,401	2,230	2,223	30	2,193
Crops (CS)	3,192	57,615	57,535	4,595	52,940	4,097	4,084	64	4,020
Hayland	352	3,711	3,705	506	3,199	452	451	7	444
Pasture	370	2,354	2,349	532	1,817	33	33	7	26
Forest	11,507	16,546	16,393	16,393	(0)	227	226	226	0
All Urban	705	5,891	5,014	783	4,231	337	294	10	284
Open Water	112	1,067	1,067	1,067	0	64	64	64	0
Animal Waste	0	32	32	0	32	2	2	0	2
Septic	-----	3,802	3,801	0	3,801	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	17,741	122,629	121,462	26,041	95,421	7,444	7,378	408	6,970

Gloucester County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	7,653	143,797	143,797	9,796	134,001	9,566	9,566	153	9,413
Crops (CS)	2,512	45,614	45,614	3,215	42,399	2,562	2,562	50	2,512
Hayland	615	6,394	6,394	788	5,606	560	560	12	548
Pasture	681	5,833	5,833	871	4,961	75	75	14	61
Forest	34,170	43,738	43,738	43,738	0	683	683	683	0
All Urban	1,788	25,547	25,547	2,288	23,259	1,734	1,734	36	1,698
Open Water	1,322	12,503	12,503	12,503	0	753	753	753	0
Animal Waste	2	4,929	4,929	3	4,926	378	378	0	378
Septic	-----	45,310	45,310	0	45,310	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	48,742	333,664	333,664	73,201	260,463	16,312	16,312	1,702	14,610

Gloucester County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	6,847	128,648	128,648	8,764	119,884	8,558	8,558	137	8,421
Crops (CS)	3,186	57,853	57,853	4,078	53,775	3,249	3,249	64	3,186
Hayland	607	6,311	6,311	777	5,533	553	553	12	541
Pasture	673	5,767	5,767	861	4,905	74	74	13	61
Forest	33,726	43,169	43,169	43,169	0	675	675	675	0
All Urban	2,380	34,013	34,013	3,047	30,966	2,309	2,309	48	2,261
Open Water	1,322	12,503	12,503	12,503	0	753	753	753	0
Animal Waste	1	2,283	2,283	1	2,281	175	175	0	175
Septic	-----	60,929	60,929	0	60,929	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	48,741	351,474	351,474	73,200	278,274	16,346	16,346	1,702	14,644

Gloucester County (Coastal Basins) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	9,956	211,074	211,074	14,437	196,637	14,835	14,835	199	14,636
Crops (CS)	3,268	59,250	59,250	4,739	54,511	4,216	4,216	65	4,150
Hayland	801	8,487	8,487	1,161	7,326	1,041	1,041	16	1,025
Pasture	886	5,602	5,602	1,285	4,316	80	80	18	62
Forest	70,092	101,634	101,634	101,634	0	1,402	1,402	1,402	0
All Urban	3,289	29,634	29,634	4,769	24,865	1,612	1,612	66	1,546
Open Water	6,191	58,810	58,810	58,810	0	3,529	3,529	3,529	0
Animal Waste	2	4,520	4,520	3	4,517	348	348	0	348
Septic	-----	37,794	37,794	0	37,794	0	0	0	0
Point Source	-----	6,831	6,831	0	6,831	2,338	2,338	0	2,338
Totals	94,485	523,636	523,636	186,838	336,798	29,399	29,399	5,295	24,104

Gloucester County (Coastal Basins) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	8,908	188,859	188,859	12,917	175,941	13,274	13,274	178	13,095
Crops (CS)	4,145	75,151	75,151	6,010	69,140	5,347	5,347	83	5,264
Hayland	790	8,377	8,377	1,146	7,231	1,027	1,027	16	1,012
Pasture	877	5,542	5,542	1,271	4,270	79	79	18	61
Forest	69,187	100,321	100,321	100,321	0	1,384	1,384	1,384	0
All Urban	4,379	39,457	39,457	6,350	33,107	2,146	2,146	88	2,058
Open Water	6,191	58,810	58,810	58,810	0	3,529	3,529	3,529	0
Animal Waste	0	0	0	0	0	0	0	0	0
Septic	-----	50,153	50,153	0	50,153	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	94,477	526,669	526,669	186,826	339,843	26,785	26,785	5,294	21,491

Gloucester County (Chesapeake Bay Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	17,609	354,871	354,871	24,232	330,638	24,401	24,401	352	24,049
Crops (CS)	5,780	104,864	104,864	7,954	96,910	6,778	6,778	116	6,662
Hayland	1,416	14,881	14,881	1,949	12,932	1,601	1,601	28	1,573
Pasture	1,567	11,434	11,434	2,156	9,278	155	155	31	123
Forest	104,263	145,372	145,372	145,372	0	2,085	2,085	2,085	0
All Urban	5,077	55,181	55,181	7,057	48,124	3,346	3,346	102	3,244
Open Water	7,512	71,313	71,313	71,313	0	4,282	4,282	4,282	0
Animal Waste	4	9,449	9,449	6	9,444	726	726	0	726
Septic	-----	83,104	83,104	0	83,104	0	0	0	0
Point Source	-----	6,831	6,831	0	6,831	2,338	2,338	0	2,338
Totals	143,228	857,300	857,300	260,039	597,261	45,711	45,711	6,996	38,714

Gloucester County (Chesapeake Bay Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	15,755	317,506	317,506	21,681	295,825	21,832	21,832	315	21,517
Crops (CS)	7,331	133,004	133,004	10,088	122,916	8,597	8,597	147	8,450
Hayland	1,398	14,688	14,688	1,923	12,764	1,580	1,580	28	1,552
Pasture	1,550	11,308	11,308	2,133	9,175	153	153	31	122
Forest	102,912	143,490	143,490	143,490	0	2,058	2,058	2,058	0
All Urban	6,759	73,470	73,470	9,397	64,074	4,455	4,455	135	4,319
Open Water	7,512	71,313	71,313	71,313	0	4,282	4,282	4,282	0
Animal Waste	1	2,283	2,283	1	2,281	175	175	0	175
Septic	-----	111,081	111,081	0	111,081	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	143,218	878,142	878,142	260,026	618,117	43,131	43,131	6,996	36,135

James City County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	669	12,563	12,563	856	11,707	836	836	13	822
Crops (CS)	1,079	19,594	19,594	1,381	18,213	1,101	1,101	22	1,079
Hayland	770	8,002	8,002	986	7,017	701	701	15	685
Pasture	1,024	8,773	8,773	1,310	7,462	113	113	20	92
Forest	16,733	21,418	21,418	21,418	0	335	335	335	0
All Urban	1,764	25,204	25,204	2,258	22,947	1,711	1,711	35	1,676
Open Water	641	6,066	6,066	6,066	0	365	365	365	0
Animal Waste	1	1,523	1,523	1	1,522	117	117	0	117
Septic	-----	9,265	9,265	0	9,265	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	22,680	112,408	112,408	34,275	78,133	5,278	5,278	806	4,471

James City County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	1,073	20,158	20,158	1,373	18,785	1,341	1,341	21	1,320
Crops (CS)	646	11,736	11,736	827	10,909	659	659	13	646
Hayland	758	7,872	7,872	970	6,902	689	689	15	674
Pasture	1,007	8,632	8,632	1,289	7,343	111	111	20	91
Forest	16,259	20,811	20,811	20,811	0	325	325	325	0
All Urban	2,300	32,874	32,874	2,945	29,929	2,231	2,231	46	2,185
Open Water	641	6,066	6,066	6,066	0	365	365	365	0
Animal Waste	0	703	703	0	703	54	54	0	54
Septic	-----	12,458	12,458	0	12,458	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	22,685	121,310	121,310	34,281	87,029	5,776	5,776	806	4,970

Note: James City County includes City of Williamsburg.

King & Queen County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	19,315	346,670	340,148	23,825	316,323	24,787	23,774	363	23,411
Crops (CS)	12,900	222,330	218,725	15,912	202,813	13,689	13,071	243	12,828
Hayland	1,657	16,488	16,160	2,044	14,116	1,522	1,468	31	1,437
Pasture	1,650	13,469	13,231	2,035	11,195	171	169	31	138
Forest	114,786	147,031	141,332	141,332	(0)	2,190	2,152	2,152	0
All Urban	5,047	69,140	68,107	6,258	61,849	4,663	4,613	96	4,517
Open Water	1,440	13,691	13,296	13,296	0	821	802	802	0
Animal Waste	6	14,627	14,339	8	14,331	1,122	1,102	0	1,102
Septic	-----	16,494	15,909	0	15,909	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	156,802	859,939	841,246	204,710	636,537	48,966	47,150	3,717	43,434

King & Queen County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	11,539	207,104	203,207	14,233	188,974	14,809	14,203	217	13,986
Crops (CS)	20,621	355,398	349,631	25,436	324,196	21,884	20,894	388	20,507
Hayland	1,654	16,459	16,132	2,040	14,092	1,520	1,466	31	1,435
Pasture	1,651	13,475	13,237	2,036	11,201	171	169	31	138
Forest	114,592	146,783	141,091	141,091	(0)	2,187	2,148	2,148	0
All Urban	5,259	72,032	70,954	6,520	64,434	4,858	4,806	100	4,706
Open Water	1,440	13,691	13,296	13,296	0	821	802	802	0
Animal Waste	3	6,528	6,528	4	6,525	501	501	0	501
Septic	-----	21,870	21,213	0	21,213	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	156,759	853,341	835,290	204,656	630,633	46,750	44,988	3,716	41,272

King & Queen County (Coastal Basins) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	2,752	58,335	58,335	3,990	54,345	4,100	4,100	55	4,045
Crops (CS)	1,838	33,321	33,321	2,665	30,656	2,371	2,371	37	2,334
Hayland	236	2,502	2,502	342	2,160	307	307	5	302
Pasture	235	1,488	1,488	341	1,146	21	21	5	16
Forest	39,371	57,088	57,088	57,088	0	787	787	787	0
All Urban	1,369	12,333	12,333	1,985	10,348	671	671	27	643
Open Water	71	672	672	672	0	40	40	40	0
Animal Waste	1	1,534	1,534	1	1,533	118	118	0	118
Septic	-----	3,721	3,721	0	3,721	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	45,873	170,994	170,994	67,084	103,910	8,415	8,415	956	7,459

King & Queen County (Coastal Basins) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	1,645	34,873	34,873	2,385	32,488	2,451	2,451	33	2,418
Crops (CS)	2,940	53,295	53,295	4,262	49,033	3,792	3,792	59	3,733
Hayland	236	2,499	2,499	342	2,157	307	307	5	302
Pasture	236	1,490	1,490	342	1,148	21	21	5	17
Forest	39,329	57,027	57,027	57,027	0	787	787	787	0
All Urban	1,425	12,836	12,836	2,066	10,771	698	698	28	670
Open Water	71	672	672	672	0	40	40	40	0
Animal Waste	0	0	0	0	0	0	0	0	0
Septic	-----	4,938	4,938	0	4,938	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	45,880	167,630	167,630	67,095	100,535	8,096	8,096	956	7,139

King & Queen County (Chesapeake Bay Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	22,067	405,004	398,483	27,815	370,668	28,887	27,874	418	27,456
Crops (CS)	14,738	255,651	252,046	18,577	233,469	16,060	15,442	279	15,162
Hayland	1,893	18,990	18,662	2,386	16,276	1,829	1,775	36	1,739
Pasture	1,886	14,957	14,719	2,377	12,342	193	190	36	155
Forest	154,157	204,120	198,420	198,420	(0)	2,978	2,939	2,939	0
All Urban	6,416	81,473	80,441	8,243	72,198	5,334	5,284	123	5,160
Open Water	1,511	14,362	13,967	13,967	0	861	842	842	0
Animal Waste	7	16,162	15,873	9	15,864	1,240	1,220	0	1,220
Septic	-----	20,215	19,630	0	19,630	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	202,674	1,030,934	1,012,241	271,794	740,447	57,381	55,566	4,673	50,893

King & Queen County (Chesapeake Bay Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	13,184	241,977	238,080	16,618	221,462	17,260	16,654	250	16,404
Crops (CS)	23,561	408,694	402,927	29,698	373,229	25,676	24,687	446	24,240
Hayland	1,890	18,959	18,631	2,382	16,249	1,826	1,772	36	1,737
Pasture	1,887	14,965	14,727	2,378	12,349	193	191	36	155
Forest	153,921	203,810	198,118	198,118	(0)	2,973	2,934	2,934	0
All Urban	6,684	84,868	83,790	8,586	75,204	5,556	5,504	128	5,375
Open Water	1,511	14,362	13,967	13,967	0	861	842	842	0
Animal Waste	3	6,528	6,528	4	6,525	501	501	0	501
Septic	-----	26,808	26,151	0	26,151	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	202,640	1,020,972	1,002,920	271,751	731,168	54,845	53,084	4,672	48,412

King William County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	25,960	482,785	480,199	32,937	447,262	32,761	32,333	512	31,821
Crops (CS)	24,737	443,773	441,747	31,385	410,362	25,549	25,191	488	24,703
Hayland	1,973	20,289	20,179	2,503	17,676	1,802	1,783	39	1,744
Pasture	4,745	40,205	40,007	6,020	33,986	519	514	94	421
Forest	114,997	147,622	145,629	145,629	(0)	2,290	2,262	2,262	0
All Urban	2,024	28,867	28,846	2,587	26,259	1,959	1,958	40	1,917
Open Water	3,008	28,492	28,287	28,287	0	1,715	1,701	1,701	0
Animal Waste	11	24,452	24,316	14	24,302	1,875	1,865	0	1,865
Septic	-----	26,295	26,070	0	26,070	0	0	0	0
Point Source	-----	614,800	614,800	0	614,800	251,272	251,272	0	251,272
Totals	177,455	1,857,580	1,850,080	249,362	1,600,718	319,742	318,880	5,136	313,744

King William County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	9,842	183,036	182,052	12,487	169,565	12,421	12,259	194	12,065
Crops (CS)	33,782	606,013	603,235	42,860	560,375	34,893	34,402	666	33,736
Hayland	1,716	17,650	17,555	2,177	15,377	1,568	1,551	34	1,517
Pasture	11,879	100,643	100,147	15,071	85,077	1,298	1,287	234	1,053
Forest	114,698	147,240	145,248	145,248	(0)	2,285	2,256	2,256	0
All Urban	2,477	35,319	35,293	3,165	32,128	2,397	2,395	49	2,346
Open Water	3,008	28,492	28,287	28,287	0	1,715	1,701	1,701	0
Animal Waste	5	11,307	11,295	6	11,289	867	866	0	866
Septic	-----	35,255	34,996	0	34,996	0	0	0	0
Point Source	-----	684,095	684,095	0	684,095	86,650	86,650	0	86,650
Totals	177,407	1,849,049	1,842,203	249,302	1,592,901	144,093	143,367	5,135	138,233

Mathews County (Coastal Basins) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	7,746	164,223	164,223	11,232	152,990	11,542	11,542	155	11,387
Crops (CS)	799	14,490	14,490	1,159	13,331	1,031	1,031	16	1,015
Hayland	836	8,864	8,864	1,213	7,651	1,087	1,087	17	1,070
Pasture	1,019	6,442	6,442	1,478	4,964	92	92	20	71
Forest	40,353	58,512	58,512	58,512	0	807	807	807	0
All Urban	3,183	28,681	28,681	4,616	24,065	1,560	1,560	64	1,496
Open Water	3,988	37,884	37,884	37,884	0	2,273	2,273	2,273	0
Animal Waste	1	3,153	3,153	2	3,151	243	243	0	243
Septic	-----	24,043	24,043	0	24,043	0	0	0	0
Point Source	-----	1,708	1,708	0	1,708	584	584	0	584
Totals	57,926	348,000	348,000	116,095	231,904	19,219	19,219	3,352	15,867

Mathews County (Coastal Basins) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	6,358	134,794	134,794	9,219	125,575	9,474	9,474	127	9,347
Crops (CS)	2,136	38,719	38,719	3,097	35,623	2,755	2,755	43	2,712
Hayland	831	8,810	8,810	1,205	7,605	1,080	1,080	17	1,064
Pasture	1,014	6,412	6,412	1,471	4,941	91	91	20	71
Forest	40,109	58,158	58,158	58,158	0	802	802	802	0
All Urban	3,483	31,380	31,380	5,050	26,330	1,707	1,707	70	1,637
Open Water	3,988	37,884	37,884	37,884	0	2,273	2,273	2,273	0
Animal Waste	0	0	0	0	0	0	0	0	0
Septic	-----	31,905	31,905	0	31,905	0	0	0	0
Point Source	-----	1,468	1,468	0	1,468	389	389	0	389
Totals	57,919	349,530	349,530	116,084	233,446	18,571	18,571	3,352	15,220

Middlesex County (Coastal Basins) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	7,864	166,719	166,719	11,403	155,316	11,718	11,718	157	11,560
Crops (CS)	628	11,385	11,385	911	10,475	810	810	13	798
Hayland	784	8,312	8,312	1,137	7,175	1,019	1,019	16	1,004
Pasture	789	4,989	4,989	1,145	3,844	71	71	16	55
Forest	24,599	35,669	35,669	35,669	0	492	492	492	0
All Urban	807	7,272	7,272	1,170	6,102	396	396	16	379
Open Water	587	5,581	5,581	5,581	0	335	335	335	0
Animal Waste	1	3,051	3,051	2	3,049	235	235	0	235
Septic	-----	11,462	11,462	0	11,462	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	36,061	254,441	254,441	57,017	197,424	15,075	15,075	1,044	14,031

Middlesex County (Coastal Basins) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	4,736	100,410	100,410	6,868	93,542	7,057	7,057	95	6,962
Crops (CS)	3,728	67,594	67,594	5,406	62,188	4,810	4,810	75	4,735
Hayland	782	8,285	8,285	1,133	7,152	1,016	1,016	16	1,000
Pasture	788	4,981	4,981	1,143	3,838	71	71	16	55
Forest	24,520	35,554	35,554	35,554	0	490	490	490	0
All Urban	925	8,335	8,335	1,341	6,994	453	453	19	435
Open Water	587	5,581	5,581	5,581	0	335	335	335	0
Animal Waste	0	0	0	0	0	0	0	0	0
Septic	-----	15,211	15,211	0	15,211	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	36,067	245,950	245,950	57,026	188,925	14,232	14,232	1,044	13,188

New Kent County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	2,300	43,209	43,209	2,943	40,266	2,874	2,874	46	2,829
Crops (CS)	4,642	84,291	84,291	5,941	78,350	4,734	4,734	93	4,642
Hayland	1,568	16,288	16,288	2,007	14,281	1,427	1,427	31	1,395
Pasture	2,129	18,249	18,249	2,726	15,524	234	234	43	192
Forest	47,759	61,131	61,131	61,131	0	955	955	955	0
All Urban	2,652	37,891	37,891	3,394	34,497	2,572	2,572	53	2,519
Open Water	3,124	29,549	29,549	29,549	0	1,780	1,780	1,780	0
Animal Waste	2	4,576	4,576	3	4,573	351	351	0	351
Septic	-----	10,836	10,836	0	10,836	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	64,174	306,021	306,021	107,694	198,327	14,928	14,928	3,001	11,927

New Kent County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	3,850	72,346	72,346	4,928	67,418	4,813	4,813	77	4,736
Crops (CS)	3,012	54,699	54,699	3,855	50,844	3,072	3,072	60	3,012
Hayland	1,550	16,103	16,103	1,984	14,119	1,410	1,410	31	1,379
Pasture	2,106	18,051	18,051	2,696	15,355	232	232	42	190
Forest	47,216	60,437	60,437	60,437	0	944	944	944	0
All Urban	3,305	47,225	47,225	4,230	42,995	3,206	3,206	66	3,140
Open Water	3,124	29,549	29,549	29,549	0	1,780	1,780	1,780	0
Animal Waste	1	2,122	2,122	1	2,121	163	163	0	163
Septic	-----	14,571	14,571	0	14,571	0	0	0	0
Point Source	-----	0	0	0	0	0	0	0	0
Totals	64,164	315,104	315,104	107,681	207,423	15,620	15,620	3,001	12,619

York County (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	1,029	19,338	19,338	1,317	18,021	1,286	1,286	21	1,266
Crops (CS)	377	6,848	6,848	483	6,365	385	385	8	377
Hayland	713	7,413	7,413	913	6,499	649	649	14	635
Pasture	1,393	11,935	11,935	1,783	10,153	153	153	28	125
Forest	28,682	36,712	36,712	36,712	0	574	574	574	0
All Urban	6,227	88,983	88,983	7,970	81,012	6,040	6,040	125	5,916
Open Water	3,793	35,878	35,878	35,878	0	2,162	2,162	2,162	0
Animal Waste	1	1,511	1,511	1	1,510	116	116	0	116
Septic	-----	17,792	17,792	0	17,792	0	0	0	0
Point Source	-----	639,677	639,677	0	639,677	154,347	154,347	0	154,347
Totals	42,214	866,087	866,087	85,057	781,029	165,712	165,712	2,930	162,782

York County (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	1,185	22,271	22,271	1,517	20,754	1,482	1,482	24	1,458
Crops (CS)	192	3,490	3,490	246	3,244	196	196	4	192
Hayland	699	7,261	7,261	894	6,366	636	636	14	622
Pasture	1,365	11,694	11,694	1,747	9,948	150	150	27	123
Forest	28,095	35,961	35,961	35,961	0	562	562	562	0
All Urban	6,924	98,940	98,940	8,862	90,078	6,716	6,716	138	6,578
Open Water	3,793	35,878	35,878	35,878	0	2,162	2,162	2,162	0
Animal Waste	0	694	694	0	694	53	53	0	53
Septic	-----	23,925	23,925	0	23,925	0	0	0	0
Point Source	-----	753,819	753,819	0	753,819	77,194	77,194	0	77,194
Totals	42,252	993,933	993,933	85,106	908,828	89,151	89,151	2,931	86,220

Lower York Region (York River Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	57,037	1,050,235	1,041,035	71,805	969,230	72,260	70,805	1,110	69,695
Crops (CS)	46,312	823,499	817,823	58,394	759,429	48,094	47,110	904	46,206
Hayland	7,310	74,998	74,553	9,255	65,298	6,673	6,599	144	6,456
Pasture	11,636	98,570	98,129	14,762	83,367	1,266	1,260	229	1,030
Forest	357,976	458,744	450,892	450,892	(0)	7,042	6,973	6,973	0
All Urban	19,878	278,575	276,679	25,073	251,606	18,855	18,762	388	18,374
Open Water	13,328	126,180	125,580	125,580	0	7,597	7,564	7,564	0
Animal Waste	23	51,697	51,269	29	51,240	3,964	3,934	0	3,934
Septic	-----	125,998	125,188	0	125,188	0	0	0	0
Point Source	-----	1,254,477	1,254,477	0	1,254,477	405,619	405,619	0	405,619
Totals	513,499	4,342,973	4,315,624	755,790	3,559,834	571,370	568,626	17,312	551,314

Lower York Region (York River Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	34,393	634,506	629,580	43,369	586,211	43,498	42,723	671	42,052
Crops (CS)	61,559	1,091,095	1,082,470	77,441	1,005,029	64,088	62,594	1,197	61,397
Hayland	6,997	71,779	71,350	8,858	62,491	6,388	6,317	137	6,179
Pasture	18,695	158,367	157,629	23,717	133,912	2,038	2,025	369	1,656
Forest	355,421	455,473	447,636	447,636	(0)	6,991	6,923	6,923	0
All Urban	23,038	323,487	321,506	29,101	292,405	21,901	21,804	451	21,353
Open Water	13,328	126,180	125,580	125,580	0	7,597	7,564	7,564	0
Animal Waste	10	23,670	23,658	13	23,645	1,815	1,814	0	1,814
Septic	-----	169,016	168,099	0	168,099	0	0	0	0
Point Source	-----	1,437,914	1,437,914	0	1,437,914	163,844	163,844	0	163,844
Totals	513,440	4,491,487	4,465,422	755,715	3,709,707	318,159	315,606	17,311	298,295

Lower York Region (Coastal Basins) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	31,166	660,714	660,714	45,190	615,523	46,437	46,437	623	45,814
Crops (CS)	8,210	148,852	148,852	11,905	136,947	10,591	10,591	164	10,427
Hayland	2,996	31,757	31,757	4,344	27,413	3,895	3,895	60	3,835
Pasture	3,286	20,768	20,768	4,765	16,003	296	296	66	230
Forest	185,100	268,394	268,394	268,394	0	3,702	3,702	3,702	0
All Urban	8,940	80,553	80,553	12,964	67,589	4,381	4,381	179	4,202
Open Water	10,949	104,012	104,012	104,012	0	6,241	6,241	6,241	0
Animal Waste	6	13,840	13,840	9	13,832	1,065	1,065	0	1,065
Septic	-----	79,880	79,880	0	79,880	0	0	0	0
Point Source	-----	8,539	8,539	0	8,539	2,922	2,922	0	2,922
Totals	250,653	1,417,309	1,417,309	451,583	965,726	79,529	79,529	11,035	68,494

Lower York Region (Coastal Basins) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	23,094	489,602	489,602	33,487	456,115	34,411	34,411	462	33,949
Crops (CS)	16,021	290,470	290,470	23,231	267,239	20,668	20,668	320	20,347
Hayland	2,977	31,560	31,560	4,317	27,243	3,871	3,871	60	3,811
Pasture	3,271	20,674	20,674	4,743	15,931	294	294	65	229
Forest	183,816	266,532	266,532	266,532	0	3,676	3,676	3,676	0
All Urban	10,523	94,816	94,816	15,259	79,557	5,156	5,156	210	4,946
Open Water	10,949	104,012	104,012	104,012	0	6,241	6,241	6,241	0
Animal Waste	0	0	0	0	0	0	0	0	0
Septic	-----	106,000	106,000	0	106,000	0	0	0	0
Point Source	-----	1,468	1,468	0	1,468	389	389	0	389
Totals	250,652	1,405,134	1,405,134	451,582	953,552	74,706	74,706	11,035	63,671

Lower York Region (Chesapeake Bay Basin) - 1985 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	88,203	1,710,949	1,701,749	116,995	1,584,754	118,697	117,242	1,733	115,508
Crops (CS)	54,522	972,352	966,675	70,299	896,376	58,685	57,701	1,068	56,633
Hayland	10,306	106,755	106,310	13,600	92,711	10,568	10,494	204	10,291
Pasture	14,922	119,338	118,896	19,527	99,370	1,562	1,555	295	1,260
Forest	543,075	727,138	719,287	719,287	(0)	10,744	10,675	10,675	0
All Urban	28,819	359,128	357,231	38,036	319,195	23,235	23,143	567	22,576
Open Water	24,276	230,192	229,592	229,592	0	13,837	13,804	13,804	0
Animal Waste	29	65,537	65,109	38	65,071	5,029	4,999	1	4,998
Septic	-----	205,878	205,068	0	205,068	0	0	0	0
Point Source	-----	1,263,016	1,263,016	0	1,263,016	408,542	408,542	0	408,542
Totals	764,152	5,760,282	5,732,933	1,207,373	4,525,560	650,899	648,155	28,347	619,808

Lower York Region (Chesapeake Bay Basin) - 1996 Nutrient Load by Source

		Nitrogen				Phosphorus			
	Area	EOS Load	Delivered	Unctrled	Ctrl Load	EOS Load	Delivered	Unctrled	Ctrl Load
Crops (CT)	57,487	1,124,108	1,119,181	76,855	1,042,326	77,909	77,134	1,133	76,001
Crops (CS)	77,580	1,381,565	1,372,940	100,673	1,272,267	84,755	83,261	1,517	81,744
Hayland	9,974	103,339	102,910	13,176	89,734	10,258	10,187	197	9,990
Pasture	21,966	179,041	178,303	28,460	149,843	2,332	2,319	434	1,885
Forest	539,236	722,006	714,168	714,168	(0)	10,667	10,599	10,599	0
All Urban	33,562	418,303	416,322	44,360	371,962	27,057	26,960	661	26,299
Open Water	24,276	230,192	229,592	229,592	0	13,837	13,804	13,804	0
Animal Waste	10	23,670	23,658	13	23,645	1,815	1,814	0	1,814
Septic	-----	275,016	274,099	0	274,099	0	0	0	0
Point Source	-----	1,439,382	1,439,382	0	1,439,382	164,233	164,233	0	164,233
Totals	764,092	5,896,621	5,870,555	1,207,297	4,663,258	392,864	390,311	28,346	361,966

York Tributary Strategy

Toxics Reduction and Prevention Strategy

The 1987 Chesapeake Bay Agreement committed the signatories to "develop, adopt and begin implementation of a basin wide strategy to achieve a reduction of toxics, consistent with the Clean Water Act of 1987, which will ensure protection of human health and living resources." This strategy was adopted by the Chesapeake Executive Council in January 1989 and initiated a multi-jurisdictional effort to define the nature, extent, and magnitude of toxics problems. The strategy was reevaluated in 1992 and resulted in the Executive Council adopting the *Chesapeake Bay Basin wide Toxics Reduction and Prevention Strategy* in October 1994. The goal was established to have the "*Bay free of toxics by reducing and eliminating the input of chemical contaminants from all controllable sources to levels that result in no toxic or bioaccumulative impact on living resources that inhabit the Bay or on human health.*" The revised strategy emphasizes a regional focus for addressing toxic problem areas, additional biological and chemical contaminant assessments in direct support of management actions, complementary activity with existing toxics regulations, and to increase emphasis on pollution prevention.

[Regional Focus]

The 1994 Toxics Strategy contains a commitment for a toxic contaminant characterization of the tidal tributaries of the Chesapeake Bay, which includes the York River. The purpose of the characterization was to establish areas that are not impacted by chemical contaminants, defined as *Areas of Low Probability for Adverse Effects*, to identify those areas that have chemical contaminant problems similar to the existing *Regions of Concern* (e.g., Elizabeth River, areas where serious chemical contaminant problems have been observed) or *Areas of Emphasis* (areas with the <u>potential</u> for serious chemical contaminant-related impacts). A fourth category includes *Areas of Insufficient or Inconclusive Data* where the data are not sufficient to place the area into one of the three categories above. Future management of chemical contaminants will be directed by the outcome of the characterization. For example, ambient toxics monitoring will be targeted in those segments listed as Areas of Insufficient Data. The characterization was finalized in June 1999 and can be found in the report entitled <u>Targeting Toxics: A characterization Report, A Tool for Directing Management and Monitoring Actions in the Chesapeake Bay's Tidal Rivers</u> (EPA 903-R-99-010).

The spatial area targeted by the toxics characterization in the York River includes the tidal areas that range from the mouth to the fall line. The River was subdivided into five segments and is described as the Lower Mobjack Bay, Upper Mobjack Bay, Lower Tidal York River, Upper Tidal York River, Tidal Mattaponi River, and Tidal Pamunkey River. The results of the 1999 characterization are as follows:

- *Lower Mobjack Bay* - This portion of the river has been characterized as an <u>Area of Insufficient or Inconclusive Data.</u> Throughout the segment the spatial and temporal coverage of chemical contaminant data was poor, and effects data were lacking.

- *Upper Mobjack Bay* – Area of Low Probability for Adverse Effects. The characterization is supported by good spatial coverage of recent sediment chemical contaminant data that were at levels well below those associated with adverse effects on living resources.

- *Lower Tidal York River*- The lower portion of the tidal York River (north of Mobjack Bay) was characterized as an Area with Low Probability for Adverse Effects. The characterization was supported by levels of sediment contaminant concentrations that were below levels that are associated with adverse effects, and the water and sediment was not toxic to Bay organisms.

- *Upper Tidal York River* – The upper portion of the York River below the Mattaponi and Pamunkey Rivers was characterized as an Area of Insufficient or Inconclusive Data (with a contaminant problem in the upper portion of the segment). In order to fill in the data gaps such that a definitive characterization can be made, the EPA Chesapeake Bay Program will perform additional monitoring in this segment during early fall of 1999. **Chemical contaminant analyses of the sediment will be augmented with ambient toxicity tests plus benthic community assessments.**

- *Tidal Mattaponi River* - This segment was characterized as An Area of Insufficient or Inconclusive Data. The spatial coverage of the sediment chemical contaminant data was very poor, and there were no other data available. In order to fill in the data gaps such that a definitive characterization can be made, the EPA Chesapeake Bay Program plans to perform additional monitoring in this segment during late summer or early fall of 2000. **Chemical contaminant analyses of the water column and sediment will be augmented with ambient toxicity tests plus benthic community assessments.**

- *Tidal Pamunkey River* - This segment was characterized as An Area of Insufficient or Inconclusive Data and was based on conflicting data. Chemical contaminant concentration data were at levels that should not cause adverse effects to living resources but yet Bay organisms exposed to sediments in the laboratory exhibited adverse effects. To address the conflicting data and fill in the data gaps such that a definitive characterization can be made, the EPA Chesapeake Bay Program plans to perform additional monitoring in this segment during late summer or early fall of 2000. **Chemical contaminant analyses of the water column and sediment will be augmented with ambient toxicity tests plus benthic community assessments.**

[Directed Toxics Assessment]

A Toxics Loading and Release Inventory (TLRI) report was released by the Chesapeake Bay Program during May 1999 (EPA 903-R-99-996). For the York River watershed, the TLRI report includes loading estimates from all VPDES dischargers in excess of 0.5 million gallons per day that have been regulated under the Commonwealth's Toxics Management Program. A single facility located above the fall line and three facilities below the fall line were included in the loadings estimates. The report also includes estimations of toxics loadings to the [Bay] watershed from non-point sources such as urban stormwater runoff, acid mine drainage, pesticide use/runoff, shipping and boating, and atmospheric deposition.

While the TLRI is not fully comprehensive and considering there is some degree of uncertainty associated with each source of contaminant loadings, the results indicate that the York River receives relatively low loadings of trace elements and moderate loads of organic contaminants (polynuclear aromatic hydrocarbons, pesticides, etc.) when compared to the other basins in the Bay.

[Regulatory Program Implementation]

The toxics prevention and reduction commitments included in this section of the strategy build upon existing state and federal legislative statutory mandates. This applies to the elimination of toxic impacts from point sources, where significant progress has been attained through the permitting process. Commitments are also included for setting reduction targets for non-point sources which include atmospheric deposition, stormwater runoff and acid mine drainage. Not as much measurable progress has been made with the non-point source discharges, although this topic is an important component of the Toxics Revision and Re-evaluation for the 1994 Strategy.

Another important part of this section was the identification of a list of key chemical contaminants (known as the Toxics of Concern) causing or having the potential to cause adverse problems in the Bay. The original intent of the list was for EPA to develop criteria for the specific contaminants. Then the jurisdictions would implement their processes for adopting their own water quality criteria based on EPA's numbers. It has since been determined that EPA will not develop criteria for these listed contaminants. For that reason the utility of the list and the need for future lists has been questioned. Currently, this issue is undergoing intense discussion within the Chesapeake Bay Program.

[Pollution Prevention]

The Pollution Prevention Work Group of the Toxics Subcommittee of the Chesapeake Bay Program coordinates and administers the voluntary pollution prevention program "Businesses for the Bay". The focus of the program is to provide public recognition to businesses, government entities, and other organizations who are voluntarily reducing their use of hazardous materials and resulting generation of hazardous materials. Businesses for the Bay focuses on reductions of the Bay Program's designated "Toxics of Concern" in the Chesapeake Bay. These reductions are achieved not through additional pre-treatment or conventional control measures, but through proactive pollution prevention techniques such as process changes, increased material usage efficiency, substitution of less toxic materials, improved inventory control techniques, technological upgrades which promote effective material reuse, and improved employee training. Other long-term measures include changes in purchasing policies and "design-for-the-environment" measures, which attempt to minimize and account for all environmental impacts from a product in the design stage.

150 Virginia businesses, government entities, and other organizations are participating in Businesses for the Bay. Last year, the Virginia members reported a total reduction of 74 million pounds due to pollution prevention measures. In addition, the Virginia members reported pollution prevention training of 4,118 employees and a total cost savings of $900,000 from pollution prevention measures.

References

1) Chesapeake Bay Program. June 1999. Targeting Toxics: A Characterization Report, A Report for Directing Management & Monitoring Actions in the Chesapeake Bay's Tidal Rivers. EPA 903-R-99-010, CBP/TRS 222/106.

2) Chesapeake Bay Program. May 1999. Chesapeake Bay Basin Toxics Loading and Release Inventory. EPA 903-R-99-006, CBP/TRS 222-100.

Best Management Practices for Nutrient and other Pollutant Control
Virginia's Lower Tributaries

Developing the nutrient reduction options require the use of a broad assortment of data and reference sources. These include discharge monitoring and treatment plant performance data, monitoring and research literature, census and land use data, and the results of water quality and watershed modeling efforts. Given the intrinsic diversity of nutrient pollution sources and control measures, there is a wide range in the estimates for nutrient reduction effectiveness of various best management practices (BMPs). Consequently, the reduction efficiencies given for the measures described here and elsewhere are based on best available information as it applies to each of the specific nutrient reduction measure. Furthermore, these reduction efficiencies have been agreed to among all the signatories of the Chesapeake Bay Agreement. Only those reduction practices known to be in widespread use and have the potential for significant reductions are taken in consideration in the calculations. Additional, if a practice is not currently accepted by the Chesapeake Bay Program participants with quantifible characteristics, it is also not considered in the reductions at this time.

Conservation Tillage. This method of crop production can be done by either planting crops into existing cover without tillage (no-till) or by utilizing tillage implements that leave most crop residue on the soil (minimum tillage). Nutrient reductions are calculated based on the difference between loading rates for cropland under conventional tillage practices versus conservation tillage found in the Chesapeake Bay Watershed (WS) Model. Costs associated with implementing conservation tillage on an individual farm varies based on numerous factors including equipment costs, topography, types and percentage of crops produced, rotation practices used, etc.

Soil Conservation & Water Quality Planning (a.k.a. Farm Plans). These plans are comprehensive natural resource management plans, but the focus is typically on the use of control practices to reduce sediment loss from cropland. Nutrient reductions for this measure were determined by an inter-jurisdictional workgroup to minimize any possible inconsistencies among the Chesapeake Bay jurisdictions and confirmed through conservation planning scenario model runs of the WS Model. Percentages of farm land under soil conservation & water quality plans were determined through a survey conducted by DCR and VPI in 1994/5. The validity of these values were confirmed by checking against acreages reported under conservation planning by NRCS. In addition, consideration is given to those jurisdictions that fall under the Chesapeake Bay Preservation Act and have, or will have, farm plans developed by CBLAD=s water quality specialists.

Nutrient Management Planning. Nutrient management is a comprehensive plan to manage the amount, placement, timing and application of animal wastes, fertilizer, sludge or residual soil nutrients to minimize nutrient loss potential while maintaining farm productivity. Nutrient reductions for this management practice were determined from nutrient management scenario model runs of the WS Model. Nutrient management plans are tailored to each individual farm and require analysis of the farm's crop production operation by a specialist versed in the development of these types of plans. Several agricultural conservation practices, such as cover crops, grazing land protection, stream protection, grassed or wooded buffers and animal waste control facilities, are tracked under the State Agricultural Cost-Share Program. Acres, or number of facilities, covered by each of these practices are based, at a minimum, on historic reported figures and projected to the year 2000 based on historic implementation patterns.

Agricultural Land Retirement. Land retirement of either highly erodible or other sensitive lands is the practice of taking agricultural land out of crop production and/or grazing and converting it by planting with a permanent vegetative cover such as grasses, shrubs and/or trees. This practice stabilizes the soil and reduces the movement of sediment and nutrients from the land. The nutrient reduction is the difference between the previous land use loading rate and that rate associated with the newly established vegetative cover. Costs to implement include the initial cost to plant the new vegetation and the loss of revenue for the former crop and/or grazing.

Grazing Land and/or Stream Protection from Livestock. These measures are used to minimize the impacts of agricultural animals on the land. Grazing land protection uses rotational grazing practices to protect pasture land and some type of watering facilities to minimize direct access to live streams. Stream protection can range from streambank stabilization to measures to exclude livestock from streams by fencing or other devices to installing livestock stream crossings. Nutrient reduction due to grazing land protection typically result in 50% reduction in nitrogen and 25% reduction in phosphorus of the expected nutrient load from pasture land. Stream protection provide varying nutrient reductions depending on the specific measures employed.

Cover Crops. Planting of cover crops, such as rye, wheat or barley, without fertilizer in the early fall traps leftover nitrogen so it will not leach into the soil and groundwater. It also reduces winter time erosion of the soil. Reduction of nutrients into receiving waters are derived from research conducted in the Bay area that has been corrected for differences in nutrient reduction efficiencies associated with operational rather than research systems. Efficiency also varies across the watershed based on climatic suitability for cover crops and hydrology. Typically there is a 35% reduction in nitrogen and 18% reduction in phosphorus of the expected nutrient load from crop and/or hayland.

Grass Filter Strips or Woodland Buffers. Vegetative buffers are established adjacent to streams and other receiving waters to filter runoff of sediment and nutrients from adjacent land uses. Nutrient reduction estimates, developed in Maryland and applied throughout the Bay, are based on available research on buffer efficiency and vary based on physiographic province and hydrology. At this time, it is estimated that forest buffers provide 50% reduction in nitrogen and 70% reduction in phosphorus of the expected nutrient load from the previous land cover. Further research is being conducted under the direction of the Chesapeake Bay Program Forest Buffer Synthesis Project to refine nutrient reduction values better. Grassed buffers are estimated to be 75% as efficient as wooded buffers. Costs to implement vary based on such variables as current condition of the stream corridor and the adjacent land uses.

Forest Harvesting Best Management Practices. This measure uses erosion & sediment control measures during forest harvesting activities. It is assumed that under proper implementation of this measure all eroding sediment is stopped and stabilized before reaching any receiving surface waters. Nutrient load reductions are estimated from data on average soil loss during harvesting activities and average nutrient content of forest soils. Typical costs of doing these practices have been accepted and borne completely by the silvicultural industry as a cost of doing business.

It is estimated that in any given year, 1% of the state's forest land is undergoing harvesting activities. The assumption is that these harvesting activities generate ten times the nutrient loads than those for undisturbed forest lands. Furthermore, it has been agreed to by the Bay participates that BMPs for forest harvesting can achieve, on average, a 50% reduction of the nutrient loads generated during harvesting. Based on discussions with the state=s silvicultural industry representative, it is expected that the industry will have 100% compliance in properly implementing BMPs for all forest harvesting acreages in Virginia by the year 2000.

Livestock Waste Management. Through the use of storage structures or lagoons to store animal waste, the waste can be used as a fertilizer source in crop production. This process reduces nutrient loads that would otherwise enter the landscape without an opportunity for further and more efficient plant uptake of the nutrient source. Nutrient reductions for this management system were determined from animal waste scenario model runs of the WS Model. Costs of implementation vary based on the number and type of animals on the farm, soil conditions of the storage facility location, nutrient needs of the crop fields, etc.

Poultry Waste Management. This measure uses storage sheds to stockpile poultry litter from partial cleanouts required after each flock of birds is removed. Based on limited data and best professional judgement, nutrient reduction due to poultry waste storage structures has been set at a faction (approximately 20%) of the WS Model reduction for livestock waste management systems for the same number of animal equivalent units (i.e., thousands of pounds of live weight). Cost to implement is dependent on similar variables as those discussed under Livestock Waste Management.

Animal Confinement Runoff (a.k.a. Loafing Lot) Management. The measure includes the use of roof runoff control, diversions, grass filters, etc. to reduce nutrient loss from water flowing through animal confinement operations. Nutrient reductions achieved by this measure vary greatly and are dependent on various factors, including the specifics practices employed, the topography of the area, distance to receiving waters, and if combined with other measures such as animal waste management systems. Research is being conducted under the direction of the Chesapeake Bay Program to contend for the inconsistencies in applying these measures and better refine the nutrient reduction typically achieved. Costs vary, as for nutrient reductions, contingent on the specific practices used and their corresponding installation and maintenance costs.

Erosion & Sediment Control. This control measure has been carried out throughout the Chesapeake Bay watershed and uses various practices such as silt fences, sediment basins, check dams, diversions, etc. to reduce sediment runoff during construction activities associated with land development. Sediment reductions are based on monitoring data that provided expected sediment yields from development activities and the performance standards of various erosion & sediment control practices. Analysis of sediment nutrient content data provided values to determine nutrient reductions. The reduction achieved by these various practices is counted in only the year in which the construction activity occurs. The cost of implementing these practices has been accepted and borne completely by the development industry as a cost of doing business.

Acreages having the probability of being under erosion & sediment control practices due to development, (i.e., disturbed acres), are reported to DCR each year. It is assumed that the acreages are nearly constant in the short term for each given year. Full compliance with the current state's erosion & sediment control regulations is expected to hold most, if not all, sediment onsite during land disturbance activities. On average in Virginia=s Lower Tributaries, effective compliance with the regulations is set at 25% for 1985 and 60% for 1996. Nutrient reductions of 33% for nitrogen and 50% for phosphorus were then adjusted based on these compliance levels.

Retrofits for Urban Best Management Practices. Modifying existing stormwater management (SWM) facilities to enhance water quality and/or retrofitting stormwater drainage systems to add water quality components in already developed areas can slow runoff, remove sediment and nutrients, and provide a basis in restoring eroded stream channels. A review of studies to date indicates that, on average, retrofitting is the most expensive reduction option per pound of nutrient removed when looking specifically at nutrient removal. Although, the other benefits of these structures, such as flood and erosion control, can justifiably offset some of these costs. To determine a typical cost benefit is difficult, as that both the cost and efficiency of these modifications and retrofits vary greatly due to their site-specific nature.

Urban Nutrient Management. Reductions under urban nutrient management are dependent on efficiency of educational efforts to modify lawn fertilizer use by homeowners and others. Current reduction estimates are based on very limited research and survey data and are tentative at best. Urban nutrient management is currently being researched under the direction of the Chesapeake Bay Program Office. This management measure is critical to prevent and/or reduce nonpoint nutrient runoff in the urban/suburban areas of the Chesapeake Bay watershed and to maintain the nutrient capped load after the reduction goals are met.

A preliminary study in 1994 shows minimal consistency in the current application of this practice, primarily due to lack of knowledge of the users of lawn fertilizers and other chemicals. Education methods are being evaluated and it is assumed that by the year 2000 these efforts will cover a minimum of 10% of all pervious urban lands within the Virginia=s Chesapeake Bay watershed. Reductions for urban nutrient management is estimated at 17% for nitrogen and 22% for phosphorus from the expected nutrient load of urban land.

Septic System Management. Septic system management within the context of the Chesapeake Bay Program includes three specific practices to reduce nutrient losses from septic systems. They include regular pumping of the system, installation of nitrogen removing (i.e., denitrification) components, and bypassing a septic system by connecting to a sanitary sewer. Currently, regular pumping of septic systems is the only practice in widespread use. Reductions are limited to nitrogen and are estimated from limited available literature and best professional judgement. Additional research is needed to quantify reductions better as that very limited data exist on delivery of nitrogen from drainfields to surface waters and on nutrient reductions from regular pumping of septic systems.

The practice of septic pumping is applied, at a minimum, to all jurisdictions that fall within the Chesapeake Bay Preservation Act (CBPA) and was initiated, on average, in 1990. It is assumed that septic pumping prevents septic system failure at a rate of 8% per 25 years. Based on research conducted by others, it is estimated that 24 pounds of nitrogen per failed system could enter the natural water system if not prevented through some method.

Shoreline Erosion Control. This control measure uses structural (i.e., riprap, revetments, etc.) and/or nonstructural (i.e., marsh grass, vegetative buffers, etc.) components to reduce the direct loss of sediment into tidal waters. Reductions are based on research conducted and published by Virginia Institute of Marine Sciences in 1992. Cost to implement is dependent on the component(s) used and length of shoreline protected.

Assessment Process from Watershed Model to Management Scenarios

- Base loads (nutrients and sediment) by source and model segment from 1985 reference watershed model scenario.
  - Landuse, point source loads and best management practices (BMPs) implementation set at 1985 levels.
  - Hydrology and atmospheric deposition are average over the period of 1984-1987.

- Nutrient and sediment loads assigned to municipalities based on their specific landuse coverage and point source locations.

- Menu of BMPs and their corresponding reduction efficiencies developed by Chesapeake Bay partners through field studies, empirical research and, where necessary, best professional judgement.

- BMP implementation levels for 1996 derived through various data sources and projected to the year 2000 based on historical trends assuming programs continue at same levels as were in place in 1996.

- Development of municipality-specific spreadsheets to summarize BMP implementation levels and their corresponding reductions through 1996 and projected to the year 2000.

- Utilize spreadsheets to evaluate various possible nutrient and/or sediment reduction management scenarios.

- Once preferred management scenarios are selected, they are combined with other management scenarios and evaluated on a regional and/or basin-wide basis.

- Results of basin-wide nutrient and/or sediment reduction management scenarios are confirmed by modifying and re-running the watershed model with the selected BMP implementation strategy.

Expanding the Best Management Practices Menu - Considerations

- Is the best management practice (BMP) in widespread use and/or result in reductions of significant amount within the context of the source load?
- Is there consistency in its application to allow for a standardized definition of the BMP?
- What is the data source for the BMP implementation level? Is the confidence level of the data source adequate? Is it available on a geographical basis? If so, how precise is it?
- Can an acceptable nutrient and/or sediment reduction efficiency be assigned to the BMP within the context of the source load?
- Is the costs of implementing the BMP practical and/or cost-effective for the results it generates?

Best Management Practices - Data Sources and/or Needs

- Conservation Tillage - high confidence level in data sources
  - Acreages derived from Conservation Technology Information Center (CTIC) annual reports by county and projected based on historic trends.
  - Adjustments also made based on loss of total agricultural land due to population growth.

- Soil Conservation & Water Quality Plans (a.k.a. Farm Plans) - moderate confidence level
  - 1994/5 survey results conducted for DCR by Virginia Tech (by basin & county) augmented with CBLAD annual planning reports by their water quality specialists.
  - Validity check conducted by comparing the acreages above with those reported under NRCS conservation plans.

- Nutrient Management Planning - high confidence level
  - Acres planned as reported by DCR and/or SWCD field staff on a quarterly basis by hydrologic unit and county.
  - Augmented with annual reports required by private certified nutrient plan writers.

- Various Agricultural BMPs through Ag Cost-Share Program - high confidence level
  - Practices include agricultural land retirement, grazing land and/or stream protection, cover crops, grass or forest buffers, loafing lot management and animal waste control facilities.
  - Number and/or acres implemented reported by DCR and/or SWCD field staff on a quarterly basis by hydrologic unit and county.

- Agricultural Land Retirement (outside of Cost-Share Program) - moderate confidence level
  - Acreages as reported by NRCS under Conservation Reserve Program (CRP) by county.

- Forest Harvesting BMPs - minimal confidence level **
  - Assumed that one percent of all forest land is undergoing harvesting activities in any given year and that voluntary compliance with proper silvicultural conservation practices is occurring toward 100% compliance by the year 2000.

- Erosion & Sediment Control - minimal to moderate confidence level
  - Acreages having the probability of being under erosion & sediment control practices due to development, (i.e., disturbed acres), are reported by DCR staff annually by hydrologic unit and county.
  - Full compliance with the current state's erosion & sediment control regulations is expected to hold most, if not all, sediment onsite during land disturbance activities. On average in Virginia's Lower Tributaries, effective compliance with the regulations is set at 25% for 1985 and 60% for 1996.

- Retrofits for Urban BMPs - no identified data source **
    - There is no known state-wide or basin-wide data source that tracks this BMP with any reliability.
    - Local municipalities may have access to this data. If so, they would have to provide information on type of structure, total acres treated, percent of acres treated that was developed pre-1985 versus post-1985.

- Urban Nutrient Management - minimal confidence level **
    - Assumed that in the Lower Tributaries there is in 1996 no urban land with this BMP implemented; and by the year 2000 ten percent of all pervious urban land will be under this BMP.

- Septic System Management - minimal to moderate confidence level
    - This BMP includes regular pumping of the system, installation of nitrogen removing (i.e., denitrification) components, and bypassing a septic system by connecting to a sanitary sewer. Currently, regular pumping of septic systems is the only practice that is accounted for within this BMP.
    - Assumed this BMP is applied, at a minimum, to all jurisdictions that fall within the Chesapeake Bay Preservation Act (CBPA) and was initiated, on average, in 1990. Number of septic systems derived from U.S. Census.

- Shoreline Erosion Control - minimal to moderate confidence level
    - Extent of BMP implementation (by basin) based on research conducted by Virginia Institute of Marine Sciences using visual survey of shoreline (video) for 1985 and 1990.

** Need more reliable or precise data.

BMP Efficiencies
Chesapeake Bay Watershed Model (Phase IV)

BMP Type	Nitrogen	Phosphorus	Sediment
Landuse Conversion	Varies by WS model segment --		
Conventional Tillage to Conservation Tillage	difference of original landuse load		
Land Retirement	to new landuse load.		
Agricultural			
Farm Plans (aka SCWQ Plans)			
Cropland (conventional tillage)	10%	40%	40%
Cropland (conservation tillage)	4%	8%	8%
Hayland	4%	8%	8%
Pasture	20%	14%	14%
Animal Waste Control (redux against manure acre)			
Dairy, Beef, or Swine	80%	80%	no reduction
Poultry	14%	14%	no reduction
Loafing Lot Management (aka Barnyard Runoff)	75%	75%	no reduction
Grazing Land Protection	50%	25%	no reduction
Nutrient Management	Varies by WS model segment --		
Cropland (conventional tillage)	4 - 53%	1 - 29%	no reduction
Cropland (conservation tillage)	4 - 47%	1 - 37%	no reduction
Hayland	1 - 43%	1 - 27%	no reduction
Cover Crops	35%	18%	18%
Streambank Protection			
Stream Protection with Fencing	75%	75%	75%
Stream Protection without Fencing	40%	40%	40%
Urban			
Erosion & Sediment Control	33%	33%	50%
Stormwater Management Retrofits			
Extended Detention (dry)	25%	20%	20%
Pond-Wetland System (in series)	29%	64%	64%
Stormwater Wetland	25%	47%	47%
Retention (wet)	32%	46%	46%
Conversion from dry to wet	32%	46%	46%
Sand Filters	30%	45%	80%
Septic Systems			
Septic Pumping	5%	no reduction	no reduction
Septic Connections	55%	no reduction	no reduction
Septic Denitrification	50%	no reduction	no reduction
Urban Nutrient Management	17%	22%	no reduction

August 12, 1999
York_D.doc

BMP Type	Nitrogen	Phosphorus	Sediment
Forest Harvesting	50%	50%	50%
Stream Restoration (non-tidal)	75%	75%	75%
Buffers (see note #2)			
Forested	57%	70%	70%
Grassed	43%	53%	53%
Shoreline Protection (tidal)			
Structural Shore Erosion Control	75%	75%	75%
Nonstructural Shore Erosion Control	75%	75%	75%
Marine Pumpouts (installation)	43%	53%	no reduction
Combined Sewer Overflows			
Treatment	15%	30%	30%
Conversion (CSO to sewer)	95%	95%	95%

Notes:

1. Sediment (i.e., TSS) reduction efficiencies are currently equated to those for phosphorus. This is used as an interim methodology until an evaluation of other methodologies is completed.
2. Buffers are treated as both a land conversion for the buffer area itself and a BMP that treats the two upland acres adjacent to the buffer.

Reference:

Chesapeake Bay Program Modeling Subcommittee. Chesapeake Bay Watershed Model Application and Calculation of Nutrient and Sediment Loadings - Appendix H: Tracking Best Management Practice Nutrient Reductions in the Chesapeake Bay Program. August 1998.

Estimated Cost of BMP to Achieve Nutrient Reduction

BMP Type	units	Cost per Unit
Conservation Tillage	acres	$21.00
Farm Plans	acres	$14.50
Nutrient Management	acres	$1.75
Highly Erodible Land Retirement	acres	$125.00
Grazing Land Protection	acres	$22.50
Stream Protection	acres	$70.00
Cover Crops	acres	$15.00
Grass Filter Strips	acres	$185.00
Woodland Buffer Filter Area	acres	$230.00
Forest Harvesting	acres	At industry expense
Animal Waste Control Facilities	systems	$18,500.00
Erosion & Sediment Control	acres	At industry expense
Urban SWM/BMP Retrofits	acres	$205.00
Urban Nutrient Management	acres	Not yet determined
Septic Pumping	systems	At homeowner expense
Shoreline Erosion Protection	linear feet	At landowner expense

Prepared by the Middle Peninsula Planning District Commission

I. Middle Peninsula Nutrient Reduction Task Force
  A. Process
  B. Statement of Purpose
  C. Statement of Principles
  D. Policy on Initial Strategies

II. Background Characteristics
  A. Agriculture and Forestry
  B. Point Sources
  C. Land Development
  D. Boating Facilities

III. Data Analysis
  A. Maps
  B. Trends 1985 - 1996

IV. Management Options

V. Implementation Criteria Plan

I. Middle Peninsula Nutrient Reduction Task Force

A. Process

The Middle Peninsula Nutrient Reduction Task Force was formed under a project funded by the Virginia Coastal Resources Management Program, the Chesapeake Bay Local Assistance Department, and the Middle Peninsula Planning District Commission. The Task Force has functioned to provide local governments in the Middle Peninsula with the opportunity to participate in the review of nutrient reduction efforts, data collection and analysis, and the policies of strategies formulation and implementation. Interaction with the State Tributary Strategies team leaders has provided task force members with input and understanding of Virginia's nutrient reduction effort.

The membership of the Nutrient Reduction Task Force was recruited through local government appointments and invitations to various stakeholders in the region. The counties of Essex, Gloucester, King and Queen, King William, Mathews, and Middlesex; the towns of Tappahannock, Urbanna, and West Point; and the Three Rivers and Tidewater Soil and Water Conservation Districts all appointed representatives to the task force. State agencies involved include the Department of Environmental Quality, Chesapeake Bay Local Assistance Department, Department of Health, and Department of Forestry. Other interested parties included the York River Watershed Coordinator, the Hampton Roads Sanitation District, and Chesapeake/ St. Laurent Paper Products. The Middle Peninsula Planning District Commission staff chaired and supported the group.

The Nutrient Reduction Task Force met on a monthly basis beginning in February of 1997. Meetings focused on education of issues, analysis of data, and discussion of implementation policies. Throughout the process it became evident that the issues were complex, data modeling was incomplete, and the limited time frame will require future revision of the strategy options as better information is developed. While the Task Force was formed to provide a conduit for information to and from each locality with the Tributary Strategies process, the lack of definite program activity at times, may not have provided the impetus to interest all local officials and the general public.

- **Middle Peninsula Nutrient Reduction Task Force - Statement of Purpose**

The Middle Peninsula Nutrient Reduction Task Force is a committee formed and supported by the Middle Peninsula Planning District Commission with appointed representatives from Middle Peninsula localities and Soil and Water Conservation Districts, and technical advisors from regional, state, and federal agencies and private organizations.

The purpose of the Task Force is to:

1) Explore the issues related to Virginia's Tributary Strategies Program;
2) Assess the ongoing efforts, and evaluate future activities of reducing nutrient pollution; and
3) Keep the localities and citizenry of the Middle Peninsula informed of the program development leading to Tributary Plans for each area Chesapeake Bay tributary.

- **Middle Peninsula - Principles for Implementation**

Background

In 1992, the Commonwealth of Virginia agreed to reduce and control point and nonpoint sources of nitrogen and phosphorus pollutants into the Chesapeake Bay by developing and implementing tributary-specific strategies. A key element of the Commonwealth's approach is to enlist the support and effort of local governments in the assessment and application of regional tributary based nutrient reductions The Middle Peninsula Planning District Commission has recognized the impact that the development of Tributary Strategies may have on the localities of the region, and therefore initiated a regional project to conduct local assessments, form the Middle Peninsula Nutrient Reduction Task Force, a working group of local officials and community leaders, and provide public education opportunities to foster dialogue and community support for the program. This regional framework provides for the coordination of governmental decisions and the participation of individuals and local governments in the planning for Tributary Strategies.

Statement of Principles

In order to guide the development and implementation of Tributary Strategies for the Lower Tributaries to the Chesapeake Bay, the Commonwealth of Virginia must consider the impacts of nutrient reduction strategies on local governments, businesses, and individuals. The following statements provide support to the goal of developing and implementing Tributary Strategies.

1. That leadership for the development of Tributary Strategies come from the Commonwealth of Virginia.

2. That the Commonwealth invite and encourage participation by interested stakeholders in the process of developing Tributary Strategies.

3. That the formulation of nutrient reduction goals be based on the application of sound scientific studies which exhibit a significant living resource response to water quality improvement.

4. That specific nutrient reduction goals be set only after relative studies are complete. The assessment of existing nutrient reduction practices and evaluation of possible future nutrient reduction practices may be initiated prior to the establishment of nutrient reduction goals.

5. That any nutrient reduction goals formulated, be applied basin-wide for each tributary. Any goals should apply to both point and nonpoint source contributors.

6. That management options considered for implementation of any established goals should have cost estimates developed prior to implementation. Management options should be ranked as to cost effectiveness giving stakeholders an evaluation of water quality improvement return for expenditures.

7. That the Commonwealth of Virginia fully commit that grants be made available to provide at least 50% of the cost of implementation / management options for both point and nonpoint source nutrient reduction.

8. That implementation and management of nutrient controls be governed in the manner most acceptable to the localities and other stakeholders involved in management strategies, and that the Commonwealth not impose mandates to implement the nutrient controls. Evaluation of effectiveness of management

strategies be conducted on an ongoing basis.

9. That the fiscal impact of nutrient reduction strategies on localities and other stakeholders be assessed to determine the need for a variety of funding resources, such as grants and loans.

10. That the implementation of nutrient reduction strategies should be voluntary, and based on incentives rather than regulation.

D. Policy on Initial Strategies

The Initial Strategies developed by the state are interim efforts to identify nutrient reduction efforts which may be undertaken in the absence of a final nutrient reduction goals for the Lower Tributaries. These strategies should not be seen as complete or all encompassing. The Middle Peninsula Planning District Commission viewed Initial Strategies and Status Reports for the Lower Tributaries as the foundation for refined final Strategies Plans to be developed later. The following statements apply to the Initial Strategies documents:

1. The localities or other stakeholders who may be identified in the Initial Plans are not financially or otherwise committed to implementation of any specific activities.

2. The localities or other stakeholders should be allowed to refine any strategies options to match with particular local needs in nutrient management.

3. Stakeholders may support the Initial Strategies without implying support for the final strategies plan.

4. Management options listed in the Initial Strategies should be interpreted broadly to allow funding qualification of projects specified by stakeholders.

5. A stakeholder beginning projects under the Initial Plans should be afforded continued consideration for those projects, even if the final plan changes the priority of such projects.

II. Background Characteristics

A. Agriculture and Forestry

The land used by agriculture and forests in the Middle Peninsula comprise of approximately 1,187 square miles, or 93% of the region. Forest lands alone are 61 % of the area and crop and pasture lands are 32%. Forest stands are hardwoods or pine, with some mixed stands. Timbered areas are usually replanted or naturally seeded to pine stands. Agricultural crops are primarily corn, soybeans, and small grains. Cotton and sorghum are grown on a smaller scale.

Two Soil and Water Conservation Districts (SWCD) serve the Middle Peninsula region. The Three Rivers SWCD includes the counties of Essex, King & Queen, and King William. The Tidewater SWCD includes the counties of Gloucester, Mathews, and Middlesex. The two SWCDs have reported a significant trend in the adoption of conservation tillage practices by the farmers in the Middle Peninsula. The following table shows the farm acres in Conventional Till (CT) and Conservation Tillage (CS):

Trends in Conservation Tillage in Middle Peninsula Counties 1985 to latest available data

TOTAL ACRES

County	**1985**		**1995**		**1996**		**% Chng.**	
Essex CT		29,084			23,638	-19		
Essex CS		16,944			17,500	+3		
Gloucester CT	15,838	14,708			-7			
Gloucester CS	5,195		9,492				+83	
King & Queen CT		18,220			11,543	-37		
King & Queen CS	12,186			31,628	+160			
King William CT	18,186			6,103		-67		
King William CS	17,453			29,947	+72			
Mathews CT		7,113		4,473				-37
Mathews CS		727		2,107				+190
Middlesex CT	16,398	7,930				-52		
Middlesex CS	1,302		10,170			+681		
Totals	158,646		169,239		+6.7			

Forest covers between 54% and 66 % of the land area of each Middle Peninsula county. The harvest of trees for lumber and pulp is a major economic activity in the region. There are several lumber mills as well as the St. Laurent Paper Products (formerly Chesapeake Paper Products) mill. Chesapeake Corporation still maintains extensive timber land holdings in the Middle Peninsula. Farmers and other landowners augment their income through the periodic harvest of trees from their lands.

The Virginia Department of Forestry is responsible for the monitoring of forest harvest activities. The local Chesapeake Bay Preservation Act ordinance provisions allow exemptions from the Resource Protection Area requirement for forestry operations, provided that Silviculture Best Management Practices (BMPs) are implemented.

Agriculture operations are also allotted special provisions in the Chesapeake Bay Preservation Act. These provisions allow the reduction in the buffer distance of the Resource Protection Area to as little as 25 feet if the farm tract complies with a written nutrient management plan and implements Best Management Practices. The Soil and Water Conservation Districts are key participants in the development of farm nutrient management plans, and work with the farmer to achieve compliance. The SWCDs also provide technical assistance and education to farmers which has resulted in BMP implementation through cost share and self (farmer) funded actions.

As the two largest land uses in the Middle Peninsula, forestry and agriculture activities can have the greatest impact on nutrient and sediment input to the waters of the region. Forests provide for nutrient uptake through the root structures, and provide for soil and stream bank stabilization. While forest harvest on any given tract of land is infrequent, if it is carelessly done, the impact can be significant. Planning for a timber harvest allows the consideration of the least damaging approach to the harvest. Agricultural crop and livestock production requires a much higher frequency of impact to the soil surface and subsurface, and the daily management of the operation allows for refinement in nutrient and soil conservation designs. For both agricultural and forestry management, there has been a need identified to better record and track the implementation and maintenance of Best Management Practices.

B. Point Sources

In the Middle Peninsula, there are approximately 50 point source discharges which are permitted by the Department of Environmental Quality. Of these, only 11 have discharge flow limits equal to or greater than 10,000 gallons per day. The largest discharges are from the St. Laurent Paper Products mill, Town of West Point, Town of Tappahannock, Town of Urbanna, and the Mathews Sanitary District. Nineteen dischargers are seafood processors and four are marinas. Since 1985 two large dischargers have discontinued their effluent flow. These are the Barnhart Duck Farm in Middlesex where the business has closed, and the Gloucester Courthouse area sewage treatment plant where the locality has connected to a force main to the Hampton Roads Sanitation District - York River facility.

The trends for nutrient treatment have been generally good for the wastewater treatment plants. The phosphate detergent ban has contributed to a substantial reduction in the nutrient in wastewater effluent. The treatment plant upgrades and the closing of two facilities have also provided a net decrease in nitrogen discharged. The municipal wastewater treatment facilities are located in Mathews, West Point, Urbanna, and Tappahannock. The Mathews and Urbanna plants are 100,000 gallon per day package plants. The Urbanna plant includes modifications to allow enhanced biological nutrient reduction (BNR), however the BNR modifications are not routinely utilized due to flow and management concerns. The West Point facility is a trickling filter system with permitted flows of 600,000 gallon per day. The Town of Tappahannock operates a 400,000 gallon per day treatment plant consisting of an oxidation ditch treatment design. The town and Essex County are partnering to double the capacity of the treatment system and plan for construction in the near future. Oxidation ditch facilities lend themselves to BNR type treatment, however, greater volume capacities are necessary for implementation. Several other localities are contemplating developing sewer infrastructure. These include King William County, King and Queen County, Middlesex County, and expansion in Mathews County.

The Hampton Roads Sanitation District has completed a study to determine the feasibility of operating the existing treatment plants in the Middle Peninsula as a division of HRSD. To date King and Queen, King William, Mathews, Middlesex, West Point and Urbanna have indicated a willingness to join the HRSD. Coordinated management and operations of the regions sewage treatment plants has the potential for a higher degree of effluent treatment quality and consistency.

C. Land Development

Local governments regulate land development activities through a variety of ordinances and inspection programs. These programs include erosion and sedimentation control, wetlands laws, stormwater programs, Chesapeake Bay Preservation Areas, and the educational effort in working with landowners and developers.

The type of development in the Middle Peninsula over the past ten years has varied by locality. Essex has seen significant commercial development in the Town of Tappahannock, as well as residential and golf course development adjacent to the town. Gloucester has also increased in commercial land uses along Route 17 near Gloucester Courthouse. Continued residential development, a new landfill, and a new industrial park are other land development projects in Gloucester County. King and Queen has also developed a new landfill, and is beginning to develop an industrial park near the Regional Airport site. King William development has been primarily residential. Mathews County has remained fairly stable in residential and commercial development. Middlesex has seen scattered commercial development, as well as continued residential growth.

The implementation of the Chesapeake Bay Preservation Act and erosion and sedimentation ordinances in the region has acted to limit the increase in nonpoint source pollution from development. The Middle Peninsula localities each have staff to implement these local programs, however, the capacity of each locality varies. There is a recognized need for consistent implementation of local land development/ environmental protection ordinances. For rural localities, there is a need to develop staffing capacity and provide technical training to local staff and citizen boards.

Local governments are beginning to track development plans and inspections by state designated hydrologic units. Consistent methodology for this tracking effort, and the ability to convert data to geographic information system coverages would greatly enhance the localities ability to manage and implement programs which provide for nutrient and sedimentation reductions.

D. Boating Facilities

The boating industry is a vital foundation to the economy of the Middle Peninsula. Just as the quality of life depends on the quality of the water, the marina industry also relies on unpolluted waters for its clientele's recreational enjoyment. There are 97 marinas in the region, with a total of 5850 wet and dry slips available for use. In addition, there are 69 Other Places Where Boats Are Moored (OPWBAM) with a total of 763 additional slips. OPWBAMs include community piers and work boat docks where no overnight occupancy is expected.

The management of marinas and OPWBAMs impacts nutrients of the surrounding waters primarily through the discharge of untreated sewage from boat holding tanks, and the runoff from parking lots and boat work areas. The Virginia Department of Health is responsible for enforcing regulations requiring sewage pump out stations at marinas.

III. Data Analysis

A. Maps

1. Hydrologic Units
2. Pollution Potential Ratings for Nonpoint Sources
3. Highly Erodible Soils
4. VPDES Permit Locations

5 - 7. Basins Land Cover

8 - 16. Rappahannock River Basin Atlas - Map Folio Reproduced for Tributary Strategies

17. Rappahannock River Basin Pollution Potential Ratings for Nonpoint Sources

B. Middle Peninsula - Nutrient Reduction Trends 1985 - 1996

County	Nitrogen	Phosphorus

(Watershed)	1985	1996	1985	1996

All numbers: lbs/year
PS - Point Source
NPS - Nonpoint Source

Essex
(Rappahannock) - 89% of County

PS	12,523	19,864	4,286	2,656
NPS	884,820	693,673	63,666	48,424
Total	897,343	713,537	67,952	51,080
Reduction	183,806		16,872	
% Reduction	**20%**		**25%**	

(York) - 0.08% of County

PS	0	0	0	0
NPS	4,627	6,098	347	427
Total	4,627	6,098	347	427
Reduction	-1,471		-80	
% Reduction	**-32%**		**-23%**	

(Coastal) - 11% of County

PS	0	0	0	0
NPS	95,690	63,564	7,033	6,025
Total	95,690	63,564	7,033	6,025
Reduction	32,126		1,008	
% Reduction	**34%**		**22%**	

Gloucester
(York) - 35% of County

PS	0	0	0	0
NPS	260,463	233,635	14,610	7,461
Total	260,463	233,635	14,610	7,461
Reduction	26,828		7,149	
% Reduction	**10%**		**49%**	

County	Nitrogen		Phosphorus	
(Watershed)	1985	1996	1985	1996

(Coastal) - 65% of County

PS	6,831		0	2,338		0	
NPS	329,967		234,414	21,767		15,589	
Total	336,798		234,414	24,105		15,589	
Reduction		102,384				8,516	
% Reduction	**30%**				**35%**		

King & Queen County
(York) - 77% of County

PS	0	0	0	0			
NPS	636,537		563,258	43,434		36,524	
Total	636,537		563,258	43,434		36,524	
Reduction		73,279			6,910		
% Reduction	**12%**				**16%**		

(Coastal) - 23% of County

PS	0	0		0		0	
NPS	103,910	71,784		7,459		5,807	
Total	103,910	71,784		7,459		5,807	
Reduction		32,126			1,652		
% Reduction	**31%**				**22%**		

King William
(York) - 100% of County

PS	614,800		684,095	251,272			81,438
NPS	985,918		825,405	62,472			48,670
Total	1,600,718		1,509,500	313,744			130,108
Reduction		91,218			183,636		
% Reduction	**5.7%**				**59%**		

Mathews
(Coastal) - 100% of County

PS	1,708		1,468	584	389		
NPS	230,197		150,829	15,283		5,656	

Total	231,905	152,297	15,867	6,045
Reduction	79,608		9,822	
% Reduction	**34%**		**62%**	

County (Watershed)	**Nitrogen 1985**	**Nitrogen 1996**	**Phosphorus 1985**	**Phosphorus 1996**
Middlesex (Rappahannock) - 55% of County				
PS	28,583	4,281	13,248	572
NPS	322,118	255,264	22,946	16,487
Total	350,701	259,545	36,194	17,059
Reduction	91,156		19,135	
% Reduction	**26%**		**53%**	
(Coastal) - 45% of County				
PS	0	0	0	0
NPS	197,424	141,489	14,031	11,891
Total	197,424	141,489	14,031	11,891
Reduction	55,935		2,140	
% Reduction	**28%**		**15%**	

IV. Management Options

Wastewater Treatment Systems

- Implement On-Site Revolving Loan Fund
- Expand sewer system service areas
- Enforce septic tank pumpout requirements - Make a duty of the Department of Health
- Innovative Wastewater Treatment Systems - dry weather land irrigation
- Incorporate Nutrient Removal Technologies into new treatment plant designs.
- Upgrade existing Sewage Treatment Plants
- Coordinate existing Sewage Treatment Plant operations

Land Development

- Identify Highly Erodible Soils on site plans, educate builder.
- Track E&S inspections by watersheds and practices.
- Demonstration BMPs at developments
- Riparian Buffer Education
- Lawn Care Education
- Fund Soil Samples

- Regional Stormwater BMPs - develop a utility management structure
- Innovative Watershed Management programs - planning and implementation

Agriculture
- Bay Act Plan and FSA Plan development
- Target efforts of plan enforcement/ BMP installation to Highly Erodible Soils and High Pollution Potential Watersheds
- Review controls of livestock wastes

Forestry
- Track BMP compliance by watershed
- Local review of harvesting plans
- Riparian Buffer incentives

Marinas
- Boater Education
- Pumpout Demonstrations/Pilots

V. Implementation Criteria Plan

Land Development Criteria

General - Local inspections of development projects tracked by Hydrologic Units

Incentive Funding - Priority Hydrologic Unit Watershed for Nonpoint Sources

Education Effort - Local officials provide customer information on nutrient pollution prevention.

Wastewater Treatment Facility Criteria

New Treatment Plants incorporate designs to maximize nutrient removal through use of Biological Nutrient Removal (BNR) or other technologies.

Existing Treatment Plants upgraded for additional nutrient removal through BNR or other technologies, only when practical and cost effective to do so.

Enhanced management and effluent testing at municipal wastewater treatment plants should be employed to better measure nutrient input and refine treatment processes.

Agricultural Production Criteria

Identify Priority Hydrologic Unit Watershed for Nonpoint Sources. Target these watersheds for implementation grant funding.

Target farm tracts lacking Nutrient Management Plans and Chesapeake Bay Preservation Act Plans.

Apply increased cost-share funding for best management practices (BMPs) through the Soil and Water Conservation Districts (SWCDs).

Forestry Timbering Criteria

A Pre Harvest Plan should be required to be submitted to the locality and approved prior to the beginning of timbering operations.

Extension of Streamside Management Zone to 100 feet buffer of wetlands and streams to coincide with Chesapeake Bay Preservation Act Resource Protection Areas delineation.

York River Basin Tributary Strategy Technical Advisory Committee

Joe S. Frank, Hampton Roads Planning District Commission Chairperson, appointed these four persons on April 15, 1998, to represent the Hampton Roads region on the York River Basin Tributary Strategy Technical Advisory Committee:

Mr. Burton R. Bland
District Program Manager/Conservation Specialist
Tidewater Soil and Water Conservation District
P.O. Box 677
Gloucester, Virginia 23061

Ms. Connie Bennett
Stormwater Engineer
Department of Environmental Services
224 Ballard Street
Yorktown, Virginia 23690

Ms. Christine Breddy
Planner
Department of Community Development
County Administration Building
Main and DuVal Streets
Gloucester, Virginia 23061

Mr. John M. Carlock
Director of Physical and Environmental Planning
Hampton Roads Planning District Commission
723 Woodlake Drive
Chesapeake, Virginia 23220

REPORT ON OBJECTIVES OF THE LOCAL GOVERNMENT PARTNERSHIP INITIATIVE

The Local Government Partnership Initiative, Executive Council Directive 95-1, recognized the need to more actively engage local governments in the Chesapeake Bay program's efforts to protect and restore the Bay. The Bay program acknowledged through this Directive the critical role that local governments must play in the actions needed to achieve the nutrient reduction goals for each tributary.

The Directive affirmed the need and committed to strengthen the working relationship between the signatories of the Bay program and local governments. In doing so, the signatories endorsed the following objectives:

- To establish a stronger working relationship and improve coordination with local governments to broaden the Program's understanding of local perspectives concerning the Chesapeake Bay watershed's protection and restoration as well as tributary nutrient reduction initiatives.

The voluntary cooperative approach used in the development of the tributary strategies embodies this commitment by the Commonwealth. In developing the Initial York Nutrient Reduction Strategy, there was face-to-face interaction with local elected officials and staff. Local elected officials were introduced to the strategy process early on and were requested to designate appropriate local staff to work with the Team leader in the development of the Initial Strategy. Meetings were held individually with each local government as well as a series of regional meetings that took place over a six month period.

- To identify local government needs and those local government technical and programmatic resources that may be available, as well as the technical and financial resources which can be made available to local governments to encourage their broader participation in Bay protection and restoration efforts.

The initial assessment process undertaken to develop the Initial York Strategy sought to do all of these things. In asking localities to assign professional staff, they were allowed to nominate the individuals they felt were most technically knowledgeable to represent technical expertise and local nutrient reduction initiatives. The document contains a discussion of the financial opportunities provided through the Water Quality Improvement Act and during the assessment process, there were a number of discussions with various local stakeholders regarding financial assistance opportunities they may consider targeting to fund local initiatives. In addition, the Initial York Strategy documents stated local needs in terms of specific nutrient reduction programs and management practices. These management practices were refined in the Final Strategy.

- To provide additional technical assistance and seek ways to make the most effective use of available financial resources and to leverage resources as may be required to improve government's capacity to become more broadly engaged in Chesapeake Bay watershed protection and restoration activities.

The enactment of the Water Quality Improvement Act went a long way to make financial resources available to local governments for Bay Program initiatives. In addition, Virginia Natural Resource agencies are working closely together to ensure that their technical and financial assistance programs are providing equitable and cost effective assistance targeted to achieve Bay program goals. The Chesapeake Bay Program Office has also taken its own steps to improve the availability of financial and technical resources for localities.

- To broaden representation of local governments within the Bay Program's existing Committee structure to assure local government ownership and involvement in implementation ofprotection and restoration policies as developed over time.

While the Chesapeake Bay Program Office has taken its own steps to seek out more local representation within its Committee structure, the Commonwealth has also taken steps to ensure this representation through appointments made by the Governor to these committees.

VA SAV																			
Hectares, 1hectare = 2.47 acres																			
Segment	1971	1974	1978	1979	1980	1981	1984	1985	1986	1987	1989	1990	1991	1992	1993	1994	1995	1996	Tier1
Rappahannock																			
TF3	0	0	0	nd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RET3	0	0	0	nd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE3	1160.08	32.83	75.52	nd	1.45	1.46	18.16	11.87	10.82	182.2	610.12	399.33	314.78	343.37	413.47	196.51	96.79	108.05	1752.45
Acres	2865	81	187		4	4	45	29	27	450	1507	986	778	848	1021	485	239	267	4329
York																			
TF4	0	0	0	nd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RET4	0	0	0	nd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LE4	244.65	30.77	19.78	nd	19.61	20.21	35.75	34.11	29.44	43.48	56.41	80.15	65.64	66.79	76.55	78.29	82.77	85.62	305.69
WE4	3187.28	2772.66	2841.07	nd	2444.76	2541.8	2879.03	2988.77	2963.98	3059.86	3843.51	4175.32	4488.49	4568.19	4635.34	4592.67	4608.57	4524.2	5843.98
LE 4 Acres	604	76	49		48	50	88	84	73	107	139	198	162	165	189	193	204	211	755
WE 4 Acres	7873	6848	7017		6039	6278	7111	7382	7321	7558	9493	10313	11087	11283	11449	11344	11383	11175	14435
James																			
TF5	0	0	0	nd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RET5	0	0	89.17	nd	0	0	0	0	13.91	0	0	0	0	0	0	0	0	0	91.28
LE5	0	7.73	8.99	nd	0	0	0	0	0	2.97	3.85	2.73	2.74	3.5	4.01	6.1	15.4	18.81	15.89
RET 5 Acres	0	0	220		0	0	0	0	34	0	0	0	0	0	0	0	0	0	225
LE 5 Acres	0	19	22		0	0	0	0	0	7	10	7	7	9	10	15	38	46	39